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AERONAUTICAL ENGINEERING

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**A CONTINUING BIBLIOGRAPHY
WITH INDEXES**

(Supplement 152)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in August 1982 in

- *Scientific and Technical Aerospace Reports (STAR)*
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Scientific and Technical Information Branch

1982

National Aeronautics and Space Administration

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INTRODUCTION

Under the terms of an interagency agreement with the Federal Aviation Administration this publication has been prepared by the National Aeronautics and Space Administration for the joint use of both agencies and the scientific and technical community concerned with the field of aeronautical engineering. The first issue of this bibliography was published in September 1970 and the first supplement in January 1971.

This supplement to *Aeronautical Engineering -- A Continuing Bibliography* (NASA SP-7037) lists 338 reports, journal articles, and other documents originally announced in August 1982 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*.

The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles.

Each entry in the bibliography consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged in two major sections, *IAA Entries* and *STAR Entries*, in that order. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* and *STAR*, including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the slight variation in citation appearances.

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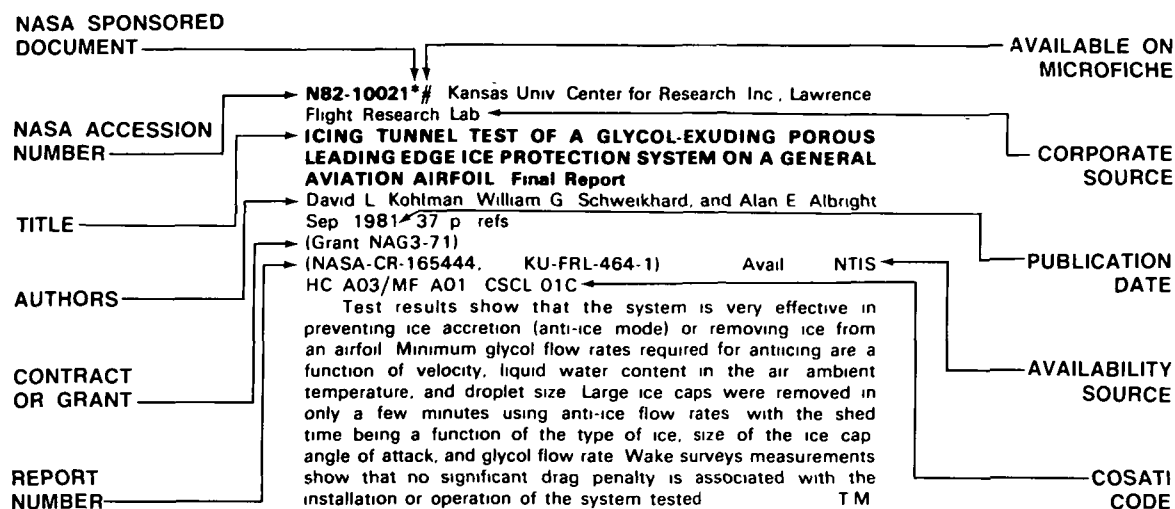
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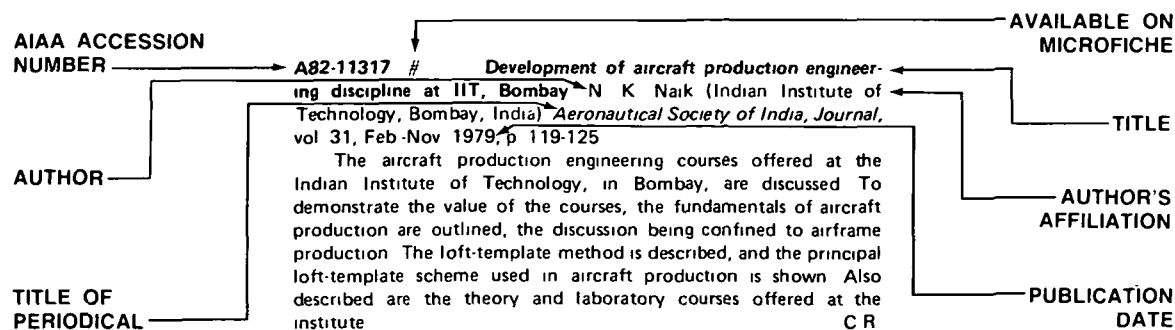
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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 152)

SEPTEMBER 1982

IAA ENTRIES

A82-31824 # Identification of the form of motion of an aircraft (Identyfikacja postaci ruchu samolotu) A Banasik *Instytut Lotnictwa, Prace*, no 86, 1981, p 13-25 In Polish

Methods for identifying the form of the motion of an arbitrary vibrating system described by a set of ordinary linear equations with constant coefficients are surveyed. The fundamental parameters of the set of equations (the state matrix, the state vector, and the dynamic stability criterion) are determined on the basis of calculated eigenvalues. The eigenvectors corresponding to particular eigenvalues are determined, which characterizes the state vector for a given eigenvalue. Particular emphasis is placed on an identification method which consists in obtaining an analytic solution of the system of differential equations of motion. Numerical examples are presented concerning the lateral dynamic stability of an aircraft treated as a rigid body B J

A82-31853 * # Approximate method of predicting heating on the windward side of Space Shuttle Orbiter and comparisons with flight data H. H. Hamilton, II (NASA, Langley Research Center, Space Systems Div., Hampton, VA). *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-0823*. 15 p 30 refs.

An approximate method is developed for predicting laminar and turbulent heating rates on the windward side of the Space Shuttle Orbiter for both the wind-tunnel and flight environments. The method is based on a 'local infinite swept cylinder' analysis and includes both equilibrium-air chemistry and variable boundary-layer-edge entropy. The method is validated by comparing with data from wind-tunnel experiments and from the first and second Space Shuttle flights both along the windward-symmetry plane and in a lateral direction off the symmetry plane. Agreement with the flight data is good from approximately 67 km (peak heating) downward. (Author)

A82-31871 # Thermodynamic performance of an airplane wing leading edge anti-icing system R. Ross (Ross Aviation Associates, Sedgwick, KS) *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-0851* 5 p

Flight data gathered from dry air tests are used to develop a procedure that will predict the spanwise and chordwise surface temperature distribution for any aircraft for either dry air or icing conditions. It is shown that wing leading edge surface temperatures can be estimated within plus or minus 5% for dry air and plus or minus 10 percent for natural icing for a wide range of aircraft conditions. The method is somewhat conservative for dry air conditions and quite conservative for icing conditions. (Author)

A82-31883 * # Radiation enhancement by nonequilibrium during flight through the Titan atmosphere C. Park (NASA, Ames Research Center, Moffett Field, CA) *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-0878* 16 p 40 refs.

The chemical reactions occurring in the adiabatic inviscid shock layer over a two-dimensional wedge flying through Titan's atmosphere are calculated. Radiative transfer through the shock layer is calculated, accounting for the deviation of electronic state populations from the equilibrium distributions, to determine the heat flux reaching the edge of the boundary layer of the proposed Titan Aerocapture vehicle. The heat fluxes are found to be larger by a ratio of up to 100,000 than those calculated under the assumption of equilibrium flow. For a typical flight, the radiative heat load reaching the edge of the boundary layer is 3.4×10 to the 5th J/sq cm, which is 5.7 times the equilibrium value. (Author)

A82-31891 * # An experimental investigation of interfacial temperatures in blade-seal material rubbing of aircraft compressors. A. F. Emery, J. Wolak, S. Etemad, and S. R. Choi (Washington, University, Seattle, WA). *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-0890* 8 p 8 refs. NASA-sponsored research.

Results are presented for the rubbing of rotating (100 m/s) titanium blade specimens, with different plasma-sprayed tip coating, against an abradable porous seal material at two different incursion rates. In general, there was a good correspondence between the average transverse force of rubbing and the seal specimen surface temperature. Instantaneous seal surface temperature measurement showed a significant temperature jump before and after each rubbing with a high rate of cooling during each revolution and a high overall temperature level. Numerical predictions of both blade and seal temperature agreed well for the bare blade tip experiments but were consistently high for the coated blades. This suggests that the thermal properties of the coatings may significantly affect the temperatures and hence the wear characteristics of the system. (Author)

A82-31898 * # Design, fabrication and test of liquid metal heat-pipe sandwich panels A. Basulis (Hughes Aircraft Co., Torrance, CA) and C. J. Camarda (NASA, Langley Research Center, Hampton, VA) *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-0903* 8 p 9 refs.

Integral heat-pipe sandwich panels, which synergistically combine the thermal efficiency of heat pipes and the structural efficiency of honeycomb sandwich panel construction, were fabricated and tested. The designs utilize two different wickable honeycomb cores, facesheets with screen mesh sintered to the internal surfaces, and potassium or sodium as the working fluid. Panels were tested by radiant heating, and the results indicate successful heat pipe operation at temperatures of approximately 922 K (1200 F). These panels, in addition to solving potential thermal stress problems in an Airframe-Integrated Scramjet Engine, have potential applications as cold plates for electronic component cooling, as radiators for space platforms, and as low distortion, large area structures. (Author)

A82-31922 # A system for the numerical simulation of sub- and transonic viscous attached flows around wing-body configurations. J. van der Vooren, J. T. van der Kolk, and J. W. Slooff (Nationaal Lucht- en Ruimtevaartlaboratorium, Amsterdam, Netherlands). *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO,*

A82-31923

June 7-11, 1982, AIAA Paper 82-0935 14 p 23 refs Research supported by the Nederlands Instituut voor Vliegtuigontwikkeling en Ruimtevaart

A computer program system used for the prediction of aircraft steady aerodynamic characteristics is presented for simulating body and fillet effects in a wing-alone code. The computational aerodynamic information system XFLO22NLR contains a geometry processor, a modified transonic flow analysis code FLO22, simulating body influence, the subsonic Panel method, the three-dimensional laminar-turbulent boundary layer code BOLA, and the post-processing system EDIPAS. The system can predict gross values of lift, pitching moment and drag of wing-body configurations, and can provide information with respect to individual drag components, pressure distributions and boundary layer quantities. Capabilities of the system are demonstrated for various transport-type wing-body configurations. D L G

A82-31923 # The equivalent simple body /ESB/ method for transonic wing analysis P J. O Neil and A Verhoff (McDonnell Aircraft Co., St. Louis, MO). *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-0936* 12 p. 10 refs. Research supported by the McDonnell Douglas Independent Research and Development Program

A procedure is presented for generating an Equivalent Simple Body (ESB) which simulates the wing/fuselage interaction of a complex fighter-type fuselage. The method is used in conjunction with state-of-the-art transonic, potential flow codes, which are limited in their ability to generate computational grids about complex fuselage geometries. The ESB representation is determined at a subcritical Mach number using the precise geometric modelling capabilities of a panel method. Mach number independence of the interaction is established for small angles of attack, thus allowing for accurate computation of wing pressures with the transonic codes. Results are shown for F-15, F/A-18, and AV-8B geometries.

(Author)

A82-31932 # A high-frequency transonic small disturbance code for unsteady flows in a cascade. G D Kerlick and D Nixon (Nielsen Engineering and Research, Inc., Mountain View, CA). *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-0955* 8 p 10 refs Contract No. N00019-81-0169.

A high-frequency version of the Ballhaus-Goorjian (1977) code LTRAN2 has been adapted to represent unsteady aerodynamic phenomena in transonic cascade flow. The modifications to the algorithm for high frequencies differ from those of Rizzetta and Chin (1979) in two ways: first, a second-order difference for the velocity potential term instead of a first order one is used, and second, a wake condition derived for the transonic small disturbance equation is applied. Then, in order to represent the cascade geometry, periodic boundary conditions and periodic tridiagonal solvers must be introduced. Examples of both oscillatory flows and indicial responses are presented. Application of the indicial method to unsteady cascades is discussed. Future work on the code will extend the applicability of the code to staggered, highly cambered cascades.

(Author)

A82-31933 * # Finite volume calculation of three-dimensional potential flow around a propeller. W-H Jou (Flow Industries, Inc., Kent, WA). *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-0957* 7 p 10 refs Contract No. NAS3-22148.

The finite volume scheme of Jameson (1977) is used to calculate potential flow around a propeller rotating at high speed. An H-type mesh is generated and used successfully in the calculations. A test calculation with a thick blade cross section shows that the present code is capable of computing the propeller flow at the advance Mach number 0.8. The possible physical mechanisms which may play an important role in the propeller aerodynamics are discussed. V L

A82-31934 # Calculation of the flow-field velocities of a wing-body-stores combination in transonic flow S N Chaudhuri, C Balasubramanian (Tennessee, University, Tullahoma, TN), and P Sundaram. *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-0958* 7 p 12 refs Contract No. F08635-80-C-0088

An integral equation method developed by Oswatitsch et al (1950, 1955) is extended to calculate the flow-field perturbation velocity components for various wing-body-pylon-external store configurations in the lateral and transverse directions. The computed flow field velocities are found to be in reasonably good agreement with pressure probe and laser Doppler velocimetry data at different Mach numbers and angles of attack for regions where strong viscous effects are absent. The method can be further extended to more complicated geometries such as multiple stores and engine intakes at both subsonic and supersonic free-stream Mach numbers. V L

A82-31935 * # Evaluation of two analytical methods for the prediction of inlet flow fields in the vicinity of generalized forebodies S F Yaros (NASA, Langley Research Center, Transonic Aerodynamics Div., Hampton, VA). *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-0959* 11 p 16 refs.

An investigation of the capability of two computer programs to simulate transonic and supersonic flows about representative fighter aircraft forebodies has been carried out for purpose of predicting flow fields in the vicinity of typical inlet locations. Each computer program is described as to its features and usage, and results are compared with comprehensive wind tunnel data. Although both computer codes were inviscid, results show that the gross aerodynamic effects of the forebody, with and without a wing, can be simulated fairly well. Further work is needed to include the effects of viscosity including vortex shedding. (Author)

A82-31944 # Hypersonic interactions with surface mass transfer I - Steady flow over a slender wedge wing R N Gupta, N K Varghese (MA College of Engineering, Kerala, India), C M Rodkiewicz (Alberta, University, Edmonton, Canada), and A C Jain (Indian Institute of Technology, Kanpur, India). *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-0979* 30 p 32 refs

The steady hypersonic interaction problem with air, argon, and helium injection is analyzed. A complete solution has been obtained for the basically nonsimilar problem of a slender wedge wing at an angle of attack. In the analysis presented here, a series solution has been developed to specify the initial condition close to the leading edge and the numerical integration is carried out downstream of this line for all the regions from strong to weak interactions including the transition. The numerical solutions have been obtained by the 'difference-differential' technique as well as by a finite-difference method. The comparative advantages and disadvantages of the two methods are discussed. The obtained results include the lift and drag coefficients, the lift to drag ratio, the position of the aerodynamic center, and the heat transfer rate per unit width of the wedge wing. A lighter gas like helium may be less appealing as a coolant due to the large induced pressures. (Author)

A82-31954 * # Subsonic 3-D surface panel method for rapid analysis of multiple geometry perturbations D R Bristow, J D Hawk (McDonnell Aircraft Co., St. Louis, MO), and J L Thomas (NASA, Langley Research Center, Hampton, VA). *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-0993* 12 p 12 refs

For any baseline aircraft configuration, a matrix of partial derivatives of surface velocity potential with respect to geometry coordinates is calculated. Linear extrapolation is then used to analyze the subcritical potential flow corresponding to a series of arbitrary small geometry perturbations. Each perturbation analysis is

more than an order of magnitude more efficient than a conventional panel method solution because no influence coefficients are calculated and no large system of linear algebraic equations is solved. Wing and wing-fuselage examples are presented to demonstrate that the predicted pressure distributions are nearly exact for large changes to wing camber, thickness, and leading edge radius (Author)

A82-31957 # Calculations of viscous transonic flow over aerofoils. Z. B. Chen and P. Bradshaw (Imperial College of Science and Technology, London, England) *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-0997*. 7 p. 9 refs

A simple and economic iterative scheme is presented for calculating compressible viscous boundary layers and wakes over aerofoils, and for matching the shear layer calculations to the calculations of the transonic potential external flows. The iterative scheme is an extension and improvement of the scheme developed by Mahgoub and Bradshaw for calculating incompressible flow. A new iterative method in the shear layer calculations has been designed and applied in the near wake region. The computing time is only a little greater than in conventional displacement-surface calculations that ignore normal pressure gradients and consequently incur errors in the near wake. Some comparisons are made with full Navier-Stokes solutions and experimental data (Author)

A82-31958 # A numerical study of the turbulent flow past an isolated airfoil with trailing edge separation. C. M. Rhie (Ford Motor Co., Detroit Diesel Allison Div., Indianapolis, IN) and W. L. Chow (Illinois University, Urbana, IL) *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-0998*. 12 p. 20 refs. Grant No. DAAG29-79-C-184

A finite volume numerical method is presented for the solution of the two-dimensional, incompressible, steady Navier-Stokes equations in general curvilinear coordinates. This method is applied to the turbulent flows over isolated airfoils with and without trailing edge separation. The standard K-epsilon model is utilized to describe Reynolds stresses. Body-fitted coordinates are generated for the computation. The solution method is an extension of the procedure developed by Gosman and Pun (1973). The performance of the K-epsilon model is assessed by comparing the predictions with the available experimental data (Author)

A82-31960 * # Numerical investigation of supersonic base flow with parallel injection. G. A. Sullins (Johns Hopkins University, Applied Physics Laboratory, Laurel, MD), J. D. Anderson, Jr. (Maryland University, College Park, MD), and J. P. Drummond (NASA, Langley Research Center, Computational Methods Branch, Hampton, VA) *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-1001*. 10 p. 11 refs. Research supported by the University of Maryland, Grant No. NCC1-41

The present investigation represents the first detailed numerical calculations of base flow with gas injection using a geometry and primary flow condition germane to a scramjet combustor. The investigation is concerned with the numerical solution of the complete two-dimensional Navier-Stokes equations for the flowfield in the vicinity of the base with parallel gas injection, taking into account the fluid dynamic aspects of this flowfield. The flow is dominated by separation, and by mixed regions of locally subsonic and supersonic flow. A comparison is conducted of flows with and without injection, and the effect of base injection on the wave patterns and shear layers of such flows is clearly established. G. R.

A82-31965 * # Three dimensional turbulent boundary layer development on a fan rotor blade. B. Lakshminarayana, C. Hah, and T. R. Govindan (Pennsylvania State University, University Park, PA). *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-1007*. 10 p. 12 refs. Grant No. NSG-3266

This paper is concerned with an experimental study undertaken to measure the boundary layer growth on a fan rotor blade. The measurements were carried out using a miniature 'X' configuration hot wire probe at various chordwise and radial locations on both surfaces of the blade. The streamwise and radial velocity profiles as well as the corresponding intensity components are interpreted and correlated. The validity of conventional velocity profiles such as the 'law of the wall' for the streamwise profile and the hodograph plot for the cross flow profile are examined. The measured values of boundary-layer gross properties are compared with the predictions based on a momentum-integral technique. (Author)

A82-31972 # Design of finite element grids for the computation of the three-dimensional transonic flow around a wing. A. Ecer, E. Citipitioglu, and B. A. Bhutta (Purdue University, Indianapolis, IN) *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-1019*. 11 p. 14 refs. Grant No. AF-AFOSR-80-0258.

The solution of the three-dimensional, transonic, potential flow equations using the finite element method is presented for the case of flow around a wing. Numerical results obtained for different computational grids are compared for studying the efficiency and accuracy of the solution as related to the choice of the computational grid. A finite element mesh generation scheme is presented which was developed for designing proper computational grids for the solution of transonic flows around three-dimensional bodies with complex geometries. The utilization of higher-order elements and their implementation in this new mesh generation technique is discussed. Also, the application of a new iterative, element based finite element solver for transonic flows is introduced. (Author)

A82-31974 * # Prediction of separated asymmetric trailing-edge flows at transonic Mach numbers. C. C. Horstman (NASA, Ames Research Center, Experimental Fluid Dynamics Branch, Moffett Field, CA). *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-1021*. 13 p. 17 refs.

Numerical simulations of the time-dependent, Reynolds averaged, Navier-Stokes equations, employing various eddy viscosity turbulence models, are presented and compared with measurements from an investigation of a transonic trailing-edge flow at a high Reynolds number. Comparisons are made for mean surface quantities as well as mean and fluctuating flow-field quantities. Solutions employing two-equation turbulence models correctly predict all the major features of the flow field. Viscous-inviscid interaction effects were found to be extremely important for predicting this flow field and equally important to the turbulence modeling employed. (Author)

A82-31978 # A vortex sheet method for calculating separated two-dimensional flows at high Reynolds number. M. Ribaut (Brown Boveri et Cie AG, Baden, Switzerland) *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St. Louis, MO, June 7-11, 1982, AIAA Paper 82-1030*. 9 p. 12 refs.

A mixed boundary condition problem for the time-averaged separated flow of a compressible and viscous fluid at high Reynolds number is formulated and solved by means of vortex and source integral equations. Application of the method to the flows past a flat plate and a blunt-trailing-edge section has shown that the extension and underpressure of the calculated wakes directly depend on the amount of vorticity diffusion and dissipation occurring in the flow. Computed velocity distributions and wake underpressures are compared with the experiment. (Author)

A82-31979 # Very large aircraft - A common response to a rapidly changing global environment. C. Dornier, Jr. (Dornier GmbH, Friedrichshafen, West Germany) *American Institute of Aeronautics and Astronautics, International Very Large Vehicles Conference, 2nd, Washington, DC, May 17, 18, 1982, Paper 82-0799*. 6 p.

A82-31980

A82-31980 # The potential of large aircraft G D Brewer (Lockheed-California Co., Burbank, CA) *American Institute of Aeronautics and Astronautics, International Very Large Vehicles Conference, 2nd, Washington, DC, May 17, 18, 1982, Paper 82-0804* 6 p

The present investigation is concerned with two designs of unconventional aircraft, both very much larger than existing equipment. One of the two designs, implemented by the Surface Effect Aircraft (SEA), takes advantage of the increase in lift/drag (L/D) which results from flying very close to the surface. In connection with their size, the vehicles were designed to operate as flying boats. It was recognized that their principal operational mode would be in transoceanic service, providing '125 knot sea lift'. At a takeoff gross weight of 1.8 million pounds one of the considered SEA is capable of carrying 810,000 pounds of payload a distance of 3450 nautical miles. Attention is also given to a study regarding the largest aircraft anyone might conceivably build, taking into account the conceptual design of a nuclear-powered aircraft which weighed nearly 12 million pounds. A military situation was conceived in which such aircraft might be used. G R

A82-31981 # Aircraft carrier - Surface effect ship. D P. Germeraad (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA). *American Institute of Aeronautics and Astronautics, International Very Large Vehicles Conference, 2nd, Washington, DC, May 17, 18, 1982, Paper 82-0808* 12 p 5 refs.

Conventional ships encounter at high speeds a wave-making drag phenomenon which increases roughly as the cube of the velocity. The Surface Effect Ship (SES) concept alleviates this deficiency by permitting the ship to ride on a cushion of air. This cushion is created by large vertical-axis fans, which are contained between twin catamaran hulls and pliant seals fore and aft. These seals are essentially transparent to wave passage. Speeds on the order of 100 knots can thus be realized. A summary is provided of developments related to two aircraft carrier SES design contracts. Attention is given to basic SES design criteria, the definition and feasibility study of a minimum size SES aircraft carrier (SES-CV), aspects of SES-CV conceptual design, and CTOL aircraft carrier options. G R

A82-31982 # Considerations for international joint venture development of very large aircraft. W A. Garrett (Lockheed-Georgia Co., Marietta, GA) and H Lese (Dornier GmbH, Friedrichshafen, West Germany) *American Institute of Aeronautics and Astronautics, International Very Large Vehicles Conference, 2nd, Washington, DC, May 17, 18, 1982, Paper 82-0809* 10 p. 5 refs.

Attention is given to a joint international civilian-military venture for the development of a common aircraft that will satisfy the growing mutual defense objectives and commercial interests of both the US and the respective European NATO countries. The high costs involved in the development and manufacture of an advanced-technology, fuel efficient, transport aircraft for the considered applications make it imperative to find an approach in which these costs are distributed among a number of partners. A description is presented of an investigation conducted by an American and a European aerospace company, relative to the prospects for a joint U.S./European NATO cooperative aircraft venture. The decision of the two companies to conduct this investigation is based on a long-standing interest in Very Large Aircraft concepts. G R

A82-31983 * # Multibody transport concept. J W Moore (Lockheed-Georgia Co., Marietta, GA) and D V Maddalon (NASA, Langley Research Center, Laminar Flow Control Projects Office, Hampton, VA). *American Institute of Aeronautics and Astronautics, International Very Large Vehicles Conference, 2nd, Washington, DC, May 17, 18, 1982, Paper 82-0810* 13 p. 8 refs.

Two baseline aircraft are configured in this study. The multibody aircraft has two fuselage bodies located at approximately 28% wing semispan. The single-body aircraft is configured in such a way as to provide a reference base with which the multibody aircraft can be compared. The aircraft are sized to provide the lowest direct operating cost configuration when transporting 771,620 lbs over a distance of 3,500 nautical miles at a cruise speed of Mach 0.80. The aircraft are assumed to operate in the years 1990-1995, thus allowing for the incorporation of those technologies expected to be mature and available for production usage in 1985. In comparison with the

single-body aircraft, the two-body aircraft shows reductions of 8.9% in wing weight, 7.7% in structural weight, 13.5% in block fuel weight, and 11.3% in direct operating cost. C R

A82-31984 * # Solar-powered airplane design for long-endurance, high-altitude flight. J W Youngblood and T A Talay (NASA, Langley Research Center, Space Systems Div., Hampton, VA) *American Institute of Aeronautics and Astronautics, International Very Large Vehicles Conference, 2nd, Washington, DC, May 17, 18, 1982, Paper 82-0811* 10 p 24 refs.

This paper describes the performance analysis and design of a solar-powered airplane for long-endurance, unmanned, high-altitude cruise flight utilizing electric propulsion and solar energy collection/storage devices. For a fixed calendar date and geocentric latitude, the daily energy balance, airplane sizing, and airplane aerodynamics relations combine to determine airplane size and geometry to meet mission requirements. Vehicle component weight loadings, aerodynamic parameters, and current and projected values of power train component characteristics form the basis of the solution. For a specified mission, a candidate airplane design is presented to demonstrate the feasibility of solar-powered long endurance flight. Parametric data are presented to illustrate the airplane's mission flexibility. (Author)

A82-31985 # System study of application of composite materials for future transport aircraft. R H Lange and J W Moore (Lockheed-Georgia Co., Marietta, GA) *American Institute of Aeronautics and Astronautics, International Very Large Vehicles Conference, 2nd, Washington, DC, May 17, 18, 1982, Paper 82-0812* 7 p. 13 refs.

The application of advanced technologies shows the potential for significant improvement in the fuel efficiency of future transport aircraft envisioned for operations in the mid to late 1990s. This paper reviews recent preliminary design system studies of advanced civil/military transport aircraft featuring cost/benefit analysis of advanced technology. Emphasis is directed toward the use of graphite/epoxy composite materials in the primary and secondary structures of transport aircraft. The aircraft design parameters include cruise Mach number of 0.80, design payload of 330,000 pounds, and 3,500 nautical miles range. (Author)

A82-31986 # Very large aircraft with alternate fuels - LH2 most promising. J C. Muehlbauer (Lockheed-Georgia Co., Marietta, GA). *American Institute of Aeronautics and Astronautics, International Very Large Vehicles Conference, 2nd, Washington, DC, May 17, 18, 1982, Paper 82-0813* 10 p. 7 refs.

Optimum designs of cargo aircraft using alternate fuels and carrying large payloads roundtrip over transoceanic distances without refueling are developed and compared. Synthetic jet propulsion (JP) fuel, liquid hydrogen (LH2) fuel, and nuclear power are considered. In relation to the JP aircraft, the LH2 aircraft is found to have lower ramp weights (by 25%) and lower trip costs (15%). The ramp weights and trip costs of the nuclear aircraft are, respectively, approximately 5 and 20% higher than those for the JP aircraft. With JP aircraft trip costs the most sensitive to fuel price, it is believed that rising prices in the future will make LH2 and nuclear power increasingly attractive. C R

A82-31987 # The potential for long-range high-payload aircraft with alternate fuels. W M Hawkins (Lockheed Corp., Burbank, CA). *American Institute of Aeronautics and Astronautics, International Very Large Vehicles Conference, 2nd, Washington, DC, May 17, 18, 1982, Paper 82-0814* 7 p 5 refs.

It is assumed that these aircraft will not be produced until the year 2005 and that they will use liquid hydrogen, which can be produced using coal, natural gas, or any other source of energy and water. With regard to propulsion, the present size of modern high-bypass engines will be employed, between 6 and 12 such units will be used on each aircraft. Control systems in use today to relieve structural loads will figure in the design, as will controls to avoid flutter, which at present are under development. Also considered possible is the use of precision rendezvous. It is pointed out that the cooling capacity of the liquid hydrogen fuel may be able to maintain laminar flow over a substantial portion of the aircraft by surface cooling. C R

A82-31988 # Beyond 2000 - The airlift challenge ahead. W T Stallings (USAF, Military Airlift Command, Scott AFB, IL) *American Institute of Aeronautics and Astronautics, International Very Large Vehicles Conference, 2nd, Washington, DC, May 17, 18, 1982, Paper 82-0815.* 6 p 16 refs

This paper discusses the present course and current concerns of the U S aviation industry. The paper suggests that the future strength of the industry could be enhanced through civil-military commonality and international cooperative agreements. A strong national air transportation policy is also advocated as a means to revitalize the industry. (Author)

A82-31991 A system design for a multispectral sensor using two-dimensional solid-state imaging arrays. R M Hodgson (Canterbury, University, Christchurch, New Zealand), F M Cady (Montana State University, Bozeman, MT), and D Pairman (Department of Scientific and Industrial Research, Physics and Engineering Laboratories, Lower Hutt, New Zealand) *IEEE Transactions on Geoscience and Remote Sensing*, vol GE-20, Apr 1982, p 177-179. 7 refs. Research supported by the University of Canterbury and University Grants Committee

A system developed for remote sensing from light aircraft in the 400-1100 nm wavelength range possesses an architecture which permits the simultaneous capture of up to four images from solid-state, two-dimensional image sensors. In operation, the array sensor captures a series of relatively rapid, approximately 10 msec exposures at intervals as long as 10 sec. This mode of operation has the advantage of nearly the same degree of distortion due to aircraft roll in all image elements. The software generation of sensor drive signals is incorporated in the system. O C

A82-31999 Army's 1st IPI program begun - Blisk impeller followup. A E Goldberger (McDonnell-Douglas Corp., St Louis, MO) *ManTech Journal*, vol 6, no 4, 1981, p 6-14. Army-supported research

A description is given of the performance-enhancement and manufacturing cost-reduction advantages of the blisk, or integral blade-disk, method of axial and centrifugal compressor rotor construction exemplified by the T700 helicopter engine. The five axial stages and single centrifugal stage of the T700 compressor rotor achieves a 15:1 compression ratio, by comparison to the 8:1 ratio of the T58 engine compressor. The blisk manufacturing approach is embodied in a single, integrated manufacturing center which employs numerical control equipment for all fabrication steps. These steps include the machining of forgings to within 0.125 in of their rectilinear configuration, ultrasonic and magnaflux inspection, and finish turning on a numerically-controlled slant bed turret lathe. Attention is given to the novel technique of abrasive flow machining for final airfoil finishing. O C

A82-32055 Recent developments in aviation cases. D L Campbell and D K. Cherry *Journal of Air Law and Commerce*, vol 47, Fall 1981, p 1-52. 342 refs.

Aviation court case decisions in 1980 are reviewed. The trend was strongly in favor of defendants, especially manufacturers and component manufacturers, with several successful motions for summary judgment. Defendants were also very often successful in enforcing contractual waivers between parties of relatively equal status. Numerous cases involved implied causes of action arising out of aviation statutes, and the trend toward enforcement of the Warsaw Convention's technical requirements continued. There were further cases alleging U.S. negligence in the publication of aeronautical charts. The courts continued to enforce coverage limitations and exclusions in aviation insurance policies. Numerous interesting decisions in the area of conflict of laws were handed down, most of them dealing with areas of great activity such as the offshore North Sea exploration and drilling operations. C D

A82-32056 Predicting the application of vicarious liability to fixed base operators - Still guesswork after all these years. L S Kaplan. *Journal of Air Law and Commerce*, vol 47, Fall 1981, p. 53-89. 168 refs

A82-32059 Aviation accident investigation - Functional and legal perspectives. C. O. Miller (System Safety, Inc., McLean,

VA). *Journal of Air Law and Commerce*, vol 46, Winter 1981, p 237-293. 187 refs

The legislative history of aviation accident investigation, current rules and procedures in investigation, probable cause in investigation and the law, and problems in investigation in relation to law and society are discussed. The Federal Aviation Act of 1958, Department of Transportation Act of 1966, Independent Safety Board Act of 1974, Federal Tort Claims Act, Freedom of Information Act, Federal Advisory Committee Act, Privacy Act, Government in the Sunshine Act, and Airline Deregulation Act are discussed in terms of their effect on accident investigation. The various rules promulgated in the area are detailed. The distinction between factual and legal cause is discussed in terms of its influence on accident investigation, particularly the problem of multiple causation. Finally, problems of openness of investigation are assessed. C D

A82-32062 Factors influencing settlement of personal injury and death claims in aircraft accident litigation. R. R. Craft, Jr. (Haight, Gardner, Poor and Havens, New York, NY) *Journal of Air Law and Commerce*, vol. 46, Summer 1981, p. 895-940. 84 refs

The Tenerife accident (March 1977) is used as a reference point in a discussion of settlement of aircraft accident litigation. The topics discussed include gathering information and contacting clients, initial role of plaintiffs' attorneys, setting up funds and making offers, multidistrict litigation and narrowing of issues, forum non conveniens; punitive damages, prejudgment interest, the roles of the judge and the attorneys for both sides, settlement negotiations, and attorneys' fees. C D

A82-32063 Aviation negotiations and the U.S. model agreement. R W Bogosian (U.S. Department of State, Office of Aviation, Washington, DC) *Journal of Air Law and Commerce*, Summer 1981, p 1007-1037. 52 refs

As historical background, the development from the liberal post-World War II Bermuda I bilateral aviation agreement to the restrictive Bermuda II agreement of 1977 is traced. The U.S. model agreement (the text of which is included) is then discussed. The 'doing business' provisions provide both parties with fair and equal opportunity to compete, and require that unfair competitive practices and discriminations be removed. One article requires complete operational freedom, subject to customs or other technical constraints. The pricing article calls for mutual disapproval pricing based upon market considerations and limits intervention to prevention of predatory or discriminatory pricing, protection of consumers from excessively high prices and of airlines from excessively low ones. The opposition of foreign aviation leaders is discussed and present achievements and future prospects are assessed. C D

A82-32135 A unified and generalized definition of static longitudinal stability in aircraft (Zur Vereinheitlichung und Verallgemeinerung des Begriffs der statischen Stabilität von Fluggeräten). R Staufenbiel (Aachen, Rheinisch-Westfälische Technische Hochschule, Aachen, West Germany) *Zeitschrift für Flugwissenschaften und Weltraumforschung*, vol 6, Mar-Apr 1982, p 74-80. 10 refs. In German.

The static stability of vibrational modes is mathematically analyzed. Equations are derived for static stability conditions that ignore Mach number and altitude, and then equations that include them are derived. A general procedure for obtaining the conditions necessary for longitudinal stability is demonstrated. C D

A82-32136 Parameter identification for structures with neighboring natural frequencies especially for the case of flight resonance tests (Parameteridentifikation bei Strukturen mit benachbarten Eigenfrequenzen, speziell bei Flugschwingungsversuchen). H Wittmeyer *Zeitschrift für Flugwissenschaften und Weltraumforschung*, vol. 6, Mar-Apr 1982, p. 80-90. 8 refs. In German.

A procedure to be used for linear vibrating systems that are viscously or structurally damped, especially where the eigenfrequencies are neighbors, is developed. The procedure is applied to a sample vibrational system with viscous damping whose symmetries have no unusual characteristics, such as a vibration test in a wind tunnel. Structural amplitudes are evaluated at several points and for several exciting frequencies. These amplitudes are the structural solutions for harmonic excitation by a set of forces whose amplitude

is independent of exciting frequency. The eigenfrequencies located in a given small interval and their proper damping values and eigen-vibrational modes are determined. Finally, potential generalizations from the procedure are applied to several variant cases. C D

A82-32137 Transformation relations for singularity avoidance in three-dimensional trajectory optimization (Transformations-beziehungen bei der Optimierung dreidimensionaler Flugbahnen zur Umgehung von Singularitäten) G-C Shau (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Dynamik der Flugsysteme, Oberrhein, West Germany) *Zeitschrift für Flugwissenschaften und Weltraumforschung*, vol. 6, Mar-Apr 1982, p. 90-98. 6 refs. In German

Problems in calculating the line of flight of an aircraft can be solved by referring the flight motion to a geodetic set of axes, translating the speed and power to that set. The equations of motion can then be written according to Newton's laws, and the right sides of these equations and their adjoint differential equations are regularly differentiable. Based on the Hamilton-Jacob theory, a procedure for translating adjoint variables to geodetic coordinates with the help of given variables in aerodynamical coordinates, and vice-versa, is developed. This will make it possible to switch the system of equations to each iteration state without losing the intermediate results. A concrete example of flight condition at 90 degrees is analyzed. C D

A82-32159 Hydrogen economy assessment for long-term energy systems in Japan T. Ohtsuka (Tohoku University, Sendai, Japan), M. Akiyama, T. Saito, Y. Ishizaki, A. Suzuki (Tokyo, Japan), N. Negishi, J. Moriya, K. Hoashi, and T. Hoshino (Industrial Research Institute, Tokyo, Japan) *International Journal of Hydrogen Energy*, vol. 7, no. 6, 1982, p. 455-462.

An assessment is made of hydrogen technology development, in particular, economy as an energy carrier, applicability for end-uses and the potential of the market in the future. Specifically, rough static cost comparisons are made on several modes of electricity transmission and hydrogen transport, and on several ways of off-peak electricity saving, including energy storage in the form of hydrogen. Then, the quantity of oil that could be saved from some representative end-use sectors if hydrogen fuel were to be introduced is discussed. Finally, a potential market is assessed, by projecting overall future energy supply/demand dynamics in Japan. (Author)

A82-32202 Shock associated noise of supersonic jets from convergent-divergent nozzles C. K. W. Tam (Lockheed-Georgia Co., Marietta, GA, Florida State University, Tallahassee, FL) and H. K. Tanna (Lockheed-Georgia Co., Marietta, GA) *Journal of Sound and Vibration*, vol. 81, Apr. 8, 1982, p. 337-358. 26 refs. Research supported by the Lockheed Internal Research and Development Funds.

Experimental and theoretical results are presented on the characteristics of shock-associated noise from imperfectly expanded supersonic jets from convergent-divergent nozzles over an extensive range of underexpanded and overexpanded operating conditions. The source of this noise is believed to be the weak but coherent interaction between the downstream-propagating large-scale turbulent flow structures in the mixing layer of the jet and the nearly periodic shock cell system. Reasoning based on this mechanism leads to the scaling formula that the intensity of shock-associated noise varies as $(M_j^2 - M_d^2)^2$, where M_j and M_d are the fully expanded jet operating Mach number and the nozzle design Mach number, respectively. A peak frequency formula is also derived from the same model. The noise intensity, directivity, and spectra of supersonic jets from a convergent-divergent nozzle of design Mach number 1.67 were measured in an anechoic chamber over the Mach number range of 1.1 to 2.0. Theoretical results agree very favorably with measurements. B J.

A82-32223 Analysis of small-aspect-ratio lifting surfaces in ground effect. J. N. Newman (MIT, Cambridge, MA) *Journal of Fluid Mechanics*, vol. 117, Apr. 1982, p. 305-314. 5 refs. Research supported by the Australian Research Grants Committee, U.S. Navy, and NSF.

A lifting surface of small aspect ratio is analysed for motion with constant forward velocity, parallel and in close proximity to a

rigid plane surface of infinite extent. The gap flow beneath the lifting surface is represented by a simple nonlinear solution in the cross-flow plane, and appropriate conditions are imposed at leading and trailing edges. The transition between these two conditions depends on the kinematics of the gap flow as well as the planform geometry. For steady-state motion of a delta wing with sufficiently large angle of attack, the transition point is upstream of the tail. For oscillatory heaving motion of a delta wing the transition point is cyclic if the heave velocity is sufficiently large. Illustrative computations of the lift force are presented. (Author)

A82-32330 * Experimental investigation of turbulent wall-jets in the presence of adverse pressure gradients in a rectangular diffuser. L. Back and R. Cuffel (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) *International Journal of Heat and Mass Transfer*, vol. 25, June 1982, p. 871-887. 7 refs. Contracts No. N00019-76-MP-67811, No. NAS7-100.

An experimental study of wall static pressure distributions and mean velocity profiles along a duct and diffuser downstream of wall-jet injection was conducted over a range of diffuser total angles from 15 to 40 deg at injection to core flow mass flux ratios from 0 to 6. Pressure recovery in the diffuser increased with injection ratio and decreased with diffuser total angle. Peak velocities in the wall-jet decayed along the flow and the inner shear layer and outer mixing region grew in thickness along the flow. The inner layer was near similarity condition, but non-similar variations were found in the outer layer. Estimated wall shear stresses depended upon injection mass fluxes, downstream distance and diffuser total angle. Greater decay of peak velocity and larger friction coefficients were found in the diffuser than indicated by correlations from data for a wall-jet without a pressure gradient. At the largest diffuser total angle and the highest injection ratio flow reversal occurred in the core region. (Author)

A82-32624 British aerospace begins update effort *Aviation Week and Space Technology*, vol. 116, May 17, 1982, p. 78, 83, 85, 86, 89.

Among the advanced production technologies selected for installation by British Aerospace Corporation's Aircraft Group are semi-automated carbon fiber production, super plastic forming/diffusion bonding (SPF-DB) of bond titanium and aluminum alloys, and introduction of direct numerical control of manufacturing processes and a CAD/CAM program. Development programs for these technologies are discussed, including a water jet carbon fiber cutting machine, a carbon fiber second fuselage that is easier to assemble, a new forming press for SPF-DB components, a pilot program for SPF-DB production which includes a 500-ton forming press, and numerically controlled robots and machine tools. C D

A82-32725 Nondestructive detection of exfoliation corrosion around fastener holes in aluminum wing skins. D. J. Hagemeyer (Douglas Aircraft Co., Long Beach, CA) *Materials Evaluation*, vol. 40, May 1982, p. 682-685.

Instructions are given for nondestructive inspections performed on the upper and lower wing skin surfaces for the presence of corrosion around fastener holes. Three methods of inspection are involved: contact ultrasonic testing, contact eddy current testing, and automated ultrasonic C-scan testing. Descriptions are given of these methods. With the contact ultrasonic test, corrosion is detected by the loss of a back surface signal. With the contact eddy current test, the phase-sensitive, eddy current instrument is calibrated to yield a maximum response difference between a corroded and uncorroded area. With the ultrasonic C-scan recording test, a flaw gate is set to record a loss of 50% signal amplitude of the back-surface signal. Here, uncorroded areas of the part are recorded, whereas corroded areas do not record. C R.

A82-32801 * Mathematical modeling of unsteady separated flow past solid airfoil cascades (Matematicheskoe modelirovanie nestatsionarnogo otrynnogo obtekania reshetok telesnykh profilov). V. N. Kotovskii, M. I. Nisht, and R. M. Fedorov *Akademiya Nauk SSSR, Doklady*, vol. 263, no. 6, 1982, p. 1326-1330. 7 refs. In Russian.

Unsteady separated flow past solid airfoil cascades is investigated using a complex approach which combines an ideal medium

scheme for a finite-thickness body in the case of the main part of the flow with boundary-layer theory in the case of the region directly adjacent to the body surface. With this approach, phenomena as complex as hysteresis in separated flow past solid bodies can be successfully simulated using a computer. It is found that as the dimensionless frequency increases, the hysteresis of the separation point decreases and the hysteresis of the normal profile force coefficient, C_n , increases. It is also shown that hysteresis, in the separation point position and in C_n increases and the hysteresis loop shifts toward the leading edge with decreasing cascade density and increasing mean angle of attack V L.

A82-32847 * # Wind-tunnel wall interference corrections for three-dimensional flows. M. H. Rizk and M. G. Smithmeyer (Flow Research Co., Kent, WA). *Journal of Aircraft*, vol. 19, June 1982, p. 465-472 11 refs

A procedure for the evaluation of wall interference corrections for three-dimensional aircraft configurations is presented. The Mach number and angle-of-attack corrections are obtained by numerically solving the Laplace equation in a parallelepiped with boundary conditions supplied mainly from experimental pressure measurements. A portion of these measurements and other wind-tunnel data required by the procedure may be replaced by theoretical estimates if not available from experiments. The accuracy of the correction results will then depend on the accuracy of these estimates. The correction procedure is applied to an isolated wing and to a wing-tail configuration in a solid-wall wind tunnel. It is found that neglecting twist and camber corrections for the wing effectively increases the tail angle-of-attack correction. Two different Mach number corrections can be calculated for the wing and tail. However, since only one Mach number correction is allowed for both the wing and the tail, and since the wing surface area is larger than the tail surface area, the final correction tends to be closer to the required wing correction. This is a source of error for the tail results (Author)

A82-32848 # Finite-element modeling of a fighter aircraft canopy acrylic panel. J. J. Labra (Southwest Research Institute, San Antonio, TX). *Journal of Aircraft*, vol. 19, June 1982, p. 480-484

A detailed three-dimensional stress analysis of a canopy aircraft acrylic panel was conducted to investigate the probable cause of a recent in-flight acrylic panel failure. The analysis was made using a general-purpose finite-element computer program. Based in part on this analysis, probable design problems associated with the canopy were identified. The study clearly demonstrates that computer-based technology can be successfully used in determining probable causes of failure in geometrically complex structures (Author)

A82-32849 # Structural modification to achieve antiresonance in helicopters. B. P. Wang, L. Kitis, W. D. Pilkey, and A. Palazzolo (Virginia, University, Charlottesville, VA). *Journal of Aircraft*, vol. 19, June 1982, p. 499-504. 12 refs. Army-supported research.

A design method is developed to create an antiresonance (by modifying structural properties) of a vibrating system under sinusoidal loading. A local modification method in which appendant systems are added to the original structure is used to analyze such systems. Since the original system and added systems are treated entirely separately, this method allows for efficient repetitive searching until the appendant system produces a meaningful reduction in vibration. Finally, the direct design of appendant structures to create antiresonance is presented. These methods are illustrated by numerical results obtained for a 44-degree-of-freedom elastic line helicopter model. (Author)

A82-32850 # Incompressible symmetric flow characteristics of sharp-edged rectangular wings. E. S. Larson (Flygtekniska Forsöksanstalten, Stockholm, Sweden). *Journal of Aircraft*, vol. 19, June 1982, p. 508-510 8 refs. Research supported by the Forsvarets Materielverk.

In a previous study (Larson, 1981), the symmetric aerodynamic characteristics of sharp-edged rectangular wings were obtained by a set of semiempirical analytical formulas that represent Lamar's (1974) extension of the Multhopp solution. A difference between theory and experiment has been noticed, however, in regard to the lift and pitching moment coefficients for all the investigated aspect

ratios except $A = 1$. The present study examines whether this discrepancy is a result of the formulation of the angle of attack squared in combination with the side-edge suction force coefficient. Improved correlation with experiments in incompressible flow up to moderately high angles of attack is obtained by using an alpha to the 5/3 dependence of the side-edge singularity of sharp-edged rectangular wings C.D.

A82-32920 * # Cloud top remote sensing by airborne lidar. J. D. Spinhirne, M. Z. Hansen, and L. O. Caudill (NASA, Goddard Space Flight Center, Greenbelt, MD). *Applied Optics*, vol. 21, May 1, 1982, p. 1564-1571 10 refs. NASA-supported research

Observations of cloud top height, backscattering, and signal depolarization have been obtained by a lidar system operating onboard a high-altitude research aircraft. The transmitter for the cloud lidar system is a doubled Nd:YAG laser operating at 5 Hz. The system functions as a fully automated sensor under microprocessor control and operates from a nominal 19-km altitude. Measurements have been acquired over a wide variety of cloud cover in conjunction with passive visible and infrared measurements. Initial observation results are reported. (Author)

A82-32979 A multifrequency adaptive radar for detection and identification of objects - Results on preliminary experiments on aircraft against a sea-clutter background. D. T. Gjessing, J. Hjelmstad, and T. Lund (Norges Teknisk-Naturvitenskapelige Forskningsrad, Kjeller, Norway). *IEEE Transactions on Antennas and Propagation*, vol. AP-30, May 1982, p. 351-365 16 refs

An experimental model of a simple multifrequency continuous wave (CW) radar system has been developed. Preliminary experiments have been performed in order to illustrate the potential of this radar concept in regard to detection, course ranging, and also identification of low flying aircraft against a sea-clutter background. The radar can be organized so as to measure ocean wave height, wave direction, and wave velocity simultaneously for 15 different ocean wavelengths ranging from 150 m to approximately 6 m. An example of such a directional wave intensity spectrum is given. To illustrate the ranging and the identification potential of the technique in regard to airplanes, two different airplane categories, namely a propeller aircraft (Cessna 172) and a jet aircraft (F-16), were flown through the radar beam. The signatures of these two airplanes are shown in two signature domains: spatial distribution of scattering centers and motion pattern. The experimental results confirm theories presented in earlier contributions. It remains to introduce two more domains, namely the space/time coherence properties of the target and its polarization characteristics (Author)

A82-32992 Radiating elements for hemispherically scanned arrays. A. T. Villeneuve (Hughes Aircraft Co., Los Angeles, CA), M. C. Behnke, and W. H. Kummer. *IEEE Transactions on Antennas and Propagation*, vol. AP-30, May 1982, p. 457-462. Contract No. F19268-72-C-0145.

Several types of radiating elements, including single slots covered by dielectric sheets, parasitic dipoles, and surface wave structures, have been investigated with reference to their wide angle scanning capabilities for application in hemispherically scanned arrays. It is shown that by using a combination of a surface wave structure and a parasitic radiator, it is possible to enhance E-plane radiation at the horizon and to broaden the H-plane pattern of a slot radiator in conducting planes and cylinders. The surface wave structure was also used with an eight-element array of slots oriented perpendicular to the array axis. This arrangement enhanced the radiation for a beam at the horizon (endfire) by several dB over that obtained from an array without the surface wave structure. V.L.

A82-33025 # The aerospace learning process. W. M. Hawkins (Lockheed Corp., Burbank, CA). *American Institute of Aeronautics and Astronautics, International Annual Meeting and Technical Display*, Baltimore, MD, May 25-27, 1982, Paper 82-1291 6 p.

A number of projects significant in the history of aerospace are reviewed and lessons to be learned are stated. The role of private industry and government in the design and production of the Hudson, the P-38, the F-80, the C-130, the Discoverer, the Polaris, and the Reentry Test Vehicle are discussed. It is contended that high quality can be achieved with significant savings of time and money.

and that bureaucracy has been a much greater problem in recent projects than it was in the older ones. Major problems include the cult of systems management, excessive paperwork and meetings, the hardware competition process, and bureaucratic infighting. It is argued that there should be a return to the quick prototype and a single systems manager should preside over projects. Competition for project contracts should be curtailed. C D

A82-33049 * Flight evaluation of Loran-C for general aviation area navigation. W. M. Hollister, K. Natarajan, and J. A. Littlefield (MIT, Cambridge, MA). *Navigation*, vol. 28, Winter 1981-1982, p. 342-352. 12 refs. Grant No. NGL-22-009-640.

This paper reports on a flight evaluation of Loran-C which was part of a long range study of area navigation systems for general aviation. Tests involved two different Loran-C receivers, 6 different aircraft, and a variety of antennas. Uncorrected position fixes were typically accurate to one quarter mile. With measured corrections, repeatability was good to within 200 ft. Signal reliability was 99.7%. The receiver was not sensitive to atmospheric noise. The time difference grid demonstrated a long term stability of 0.3 microsecond. Vertical whip and ADF E-field antennas were found suitable for airborne use. Loran-C was found satisfactory for instrument approaches to runways at general aviation airports where published latitude-longitude coordinates were available. Accuracy was further improved by using locally measured Loran-C time difference coordinates. (Author)

A82-33050 Applications of a multiplexed GPS user set. C. R. Johnson, P. W. Ward, M. D. Turner, and S. D. Roerman (Texas Instruments, Inc., Lewisville, TX). *Navigation*, vol. 28, Winter 1981-1982, p. 353-369. 7 refs.

A multiplexing GPS receiver has been developed that has many of the advantages of a continuous receiver at the low cost of a sequencing receiver. The multiplexing concept is explained. The receiver architecture is described. Advantages of multiplexing over the conventional receiver are highlighted. Applications of the multiplexing receiver to meet requirements now being met with single-channel, two-channel, and five-channel sets are discussed. Data comparing the performance of this multiplexing to conventional approaches are presented. A multiplexing GPS receiver solves difficult problems. Several of these applications are presented, including angle determination, single-channel differential GPS, area navigation and precision approach, and geodetic surveying. All applications examined have yielded a unique advantage with the multiplexed GPS receiver over a conventional GPS receiver. (Author)

A82-33095 No-tail-rotor helicopter tests continue. R. R. Ropelewski. *Aviation Week and Space Technology*, vol. 116, May 24, 1982, p. 57, 60, 61.

The experimental OH-6 helicopter uses a low-pressure air circulation yaw control system, in place of a conventional tail rotor, which consists of a small-diameter fan at the forward end of the tail boom, a slot on the lower right side of the boom, and selectively-controlled exhaust vanes at the extreme rear of the boom which provide direct thrust when additional yaw control is needed. A reduction in noise and vibration levels typical of conventional tail rotors has been demonstrated by the novel directional control system, and it is found that the helicopter's vertical tail becomes effective more quickly in forward flight. Confined-area operation hazards associated with conventional tail rotors have been obviated. Full directional control authority is maintained by the no-tail rotor system at speeds below 30 knots. O C

A82-33119 # Fundamental torsional frequency of a class of solid wings. E. H. Mansfield (Royal Aircraft Establishment, Farnborough, Hants, England). *AIAA Journal*, vol. 20, June 1982, p. 845-848.

This paper determines the fundamental torsional frequency of certain wings whose polar moment of inertia is proportional to the torsional rigidity at any section, as in a solid wing with a fixed t/c ratio. An inverse method of analysis is used in which the spanwise variation of rigidity and polar moment of inertia is related to an assumed spanwise variation of rotation in the fundamental torsional mode. The usefulness of this apparently hit-or-miss technique stems from the ease with which families of solutions may be generated. The

results, which are augmented by a direct solution for wings with a constant taper, are expressed graphically in a form which relates the fundamental torsional frequency to the derived spanwise variation of the chord. (Author)

A82-33120 * # Closed-form solutions of supersonic wing-body interference. N. R. Vira and D.-N. Fan (Howard University, Washington, DC). *AIAA Journal*, vol. 20, June 1982, p. 855-857. Contract No. NAS5-24242.

Closed-form formulas are presented for the interference factors of a body in the presence of a wing at supersonic speeds, when a finite afterbody is introduced. In addition, formulas are obtained for those cases in which the base of the body is forward of the trailing edge of the exposed root chord. These formulas are shown to be valid, subject to the restrictions inherent in the formulation given by Pitts, Nielsen and Kaattari (1959). O C

A82-33125 Aircraft evaluation in air network planning. A. Kanafani and A. Ghobrial (California, University, Berkeley, CA). *ASCE, Transportation Engineering Journal*, vol. 108, May 1982, p. 282-300. 9 refs.

The relationship between aircraft technology and the structure of air service networks in short haul systems is investigated. The analysis is based on an optimal frequency assignment model that is integrated with a route choice model. Together these models allow the optimization of aircraft utilization and define an optimal network structure for a given demand pattern and aircraft technology. Large aircraft have a compelling advantage due to the scale economies they enjoy. Small aircraft, on the other hand, can offer level-of-service advantages and an opportunity for reducing the dependence on congested major transfer hubs in the network. A desirable technology development trend would be aimed at eliminating the diseconomies of distance suffered by small aircraft due to their limited payload-range characteristics. (Author)

A82-33143 # Ideal ramjet - Optimum M sub infinity for fuel limit and material limit. J. A. Roux (Mississippi, University, University, MS). *Journal of Spacecraft and Rockets*, vol. 19, May-June 1982, p. 286, 287.

The derivation of some simple algebraic expressions for the value of the freestream Mach number at which the specific impulse obtains a maximum for both the fuel-limited and material-limited cases is presented. Equations are given by which values of the freestream Mach number can be quickly determined. The dependence of this number on the increase in stagnation temperature due to combustion, on the maximum temperature, and on T sub infinity is given in explicit form. C R

A82-33250 Principles of efficient energy use at Interflug (Grundsätze der rationellen Energieanwendung bei der Interflug). K. Henkes (Ministerium für Verkehrswesen, Gesellschaft für Internationalen Flugverkehr mbH, Berlin, East Germany). *Technisch-ökonomische Information der zivilen Luftfahrt*, vol. 17, no. 5-6, 1981, p. 214-220. In German.

Attention is given to the problems of efficient energy use in civil aviation, taking into account conditions in the German Democratic Republic and its Interflug airline. It is pointed out that 98% of the energy requirements of Interflug are met with the aid of energy carriers produced from petroleum. These energy carriers are almost exclusively aircraft fuels, and 50% of the fuel is obtained in refueling operations conducted in foreign countries. Interflug has, therefore, been concerned with the implementation of approaches for reducing the performance-related fuel consumption for its aircraft. A reduction in performance-related fuel consumption of 10-16% for each aircraft type could be achieved. This reduction is partly the result of organizational steps leading to a more efficient utilization of the aircraft, and partly the result of a number of suitable technical-technological procedures. Plans are discussed for a further reduction of the requirements for fuel and electric power by a variety of different approaches. G R

A82-33274 A documented example of strong wind-shear. D. A. Membrey (IAL, Bahrain). *Weather*, vol. 37, Jan 1982, p. 19-22. 5 refs.

It is noted that wind variations likely to be encountered by an

aircraft on takeoff or landing are usually estimated from a nearby anemometer some 33 ft above the runway. This wind, however, may not be representative of conditions at higher levels. An urgent need is therefore seen to detect and measure rapid changes in both the horizontal and vertical components up to 1000 ft. A device that can detect rapid velocity changes in clear air by remote sensing techniques is needed. Attention is given to the advances that have been made using a pulsed CO₂ laser Doppler system. When an aircraft encounters a sudden decrease in headwind, the indicated airspeed drops by an equal amount. The subsequent lift is somewhat lower than the original value. To immediately correct the situation, power is applied so that the aircraft can regain lost airspeed and climb back to the glide path. The aircraft may at this juncture be in a critical position, where an increase in thrust produces only a slight increase in lift, accompanied by a tremendous increase in drag. C R

A82-33309 Forward-swept-wing technology G Warwick
Flight International, vol. 121, May 22, 1982, p. 1317-1319.

The demonstration X-29A forward-swept-wing airplane designed by Grumman is described, and other aspects of forward-swept-wing technology are discussed. The X-29A is powered by a single 16,000 lb thrust General Electric F404 turbofan engine, and combines forward sweep with close-coupled canard, digital fly-by-wire with relaxed static stability, aeroelastic tailoring with composite primary structure, and a thin supercritical airfoil with discrete variable camber. The wing has carbonfiber-epoxy skins and front spar, and a full-depth aluminum honeycomb substructure. Composite construction controls the nose-up twisting which forces the wing to diverge, and divergence speed is increased until it lies outside the X-29A's flight envelope. The wing can sustain higher pressures before shock-induced buffet appears, increasing the usable lift in transonic maneuvers. Canard, variable-camber flaperons and strake flaps are used to trim the aircraft. C D.

A82-33317 * # The cryogenic wind tunnel for high Reynolds number testing R A Kilgore (NASA, Langley Research Center, Hampton, VA) *International Cryogenic Engineering Conference, 9th, Kobe, Japan, May 11-14, 1982, Paper 7 p 9 refs*

An improved way to increase the Reynolds numbers capability of wind tunnels has been developed at the Langley Research Center. Cooling the test gas to cryogenic temperatures by spraying liquid nitrogen into the tunnel circuit increases Reynolds number with no increase in dynamic pressure and a reduction in drive power. In addition, the ability to vary the temperature of the test gas independently of pressure and Mach number allows for the first time the independent determination of Reynolds number, Mach number, and aerodynamic effects. A new fan-driven transonic cryogenic tunnel being built at the Langley Research Center will provide an order of magnitude increase in Reynolds number capability over existing transonic tunnels in the United States when it is completed later this year. (Author)

A82-33318 * # Generation of three-dimensional boundary-fitted curvilinear coordinate systems for wing/wing-tip geometries using the elliptic solver method. F C Thames (NASA, Langley Research Center, Hampton, VA). *Symposium on the Numerical Generation of Curvilinear Coordinate Systems and the Use in the Numerical Solution of Partial Differential Equations, Nashville, TN, Apr. 13-16, 1982, Paper 23 p 12 refs*

A three-dimensional elliptic solver technique is utilized to generate surface-fitted coordinates about wing/wing-tip configurations. The method is applicable to wings of arbitrary section profile and camber, leading-edge sweep, taper ratio, and spanwise thickness variation. The basic theory of three-dimensional elliptic mappings is developed along with a method to compute interior coordinate control functions. Examples of grids generated about several wing/wing-tip geometries are given. A 49 x 33 x 17 grid requires about 3 minutes of CPU time on a CYBER 203 computer. (Author)

A82-33325 * # Aerodynamic interactions with turbulent jet exhaust plumes R G Wilmoth (NASA, Langley Research Center, Hampton, VA) *Joint Army-Navy-NASA-Air Force Interagency Propulsion Committee, Plume Technology Meeting, 13th, Houston, TX, Apr. 27-29, 1982, Paper 17 p 14 refs*

The importance of aerodynamic interactions associated with

external flow-field effects on turbulent jet exhaust plume structure is discussed. A viscous/inviscid prediction technique is presented which combines the overlaid mixing and inviscid plume components of the JANNAP Standardized Plume Flow-Field (SPF) model with inviscid external flow and boundary-layer analyses for treating nozzle afterbodies at subsonic/transonic speeds. Validation of the technique via comparisons between predictions and experiment for cold-air jet plumes is presented. Predicted spatial temperature distributions for hot, nonafterburning plumes are presented and compared to results obtained from more simplified prediction techniques in order to assess the importance of the aerodynamic interactions associated with external boundary layers and pressure gradients. It is demonstrated that these interactions play a significant role in determining the near-field turbulent mixing and inviscid plume shock structure. The implication of these results to plume radiation predictions is discussed. (Author)

A82-33326 * # Status of the national transonic facility L W McKinney and B B Gloss (NASA, Langley Research Center, Hampton, VA) *American Institute of Aeronautics and Astronautics, Aerodynamic Testing Conference, 12th, Williamsburg, VA, Mar. 22-24, 1982, Paper 82-0604 11 p 16 refs*

The National Transonic Facility at NASA Langley Research Center, scheduled for completion in July, 1982, is described with emphasis on model and instrumentation activities, calibration plans and some initial research plans. Performance capabilities include a Mach number range of 0.2-1.2, a pressure range of 1-9 atmospheres, and a temperature range of 77-350 K, which will produce a maximum Reynolds number of 120 million at a Mach number of 1.0, based on a 0.25 m chord. A comprehensive tunnel calibration program is planned, which will cover basic tunnel calibration, data qualities, and data comparisons with other facilities and flights. D L G

A82-33327 * # The NASA Langley laminar flow control airfoil experiment W D Harvey and J D Pride (NASA, Langley Research Center, Hampton, VA) *American Institute of Aeronautics and Astronautics, Aerodynamic Testing Conference, 12th, Williamsburg, VA, Mar. 22-24, 1982, Paper 82-0567 26 p 45 refs*

A large chord swept supercritical LFC airfoil has been constructed for NASA-Langley's research program to determine the compatibility of supercritical airfoils with suction laminarization and to establish a technology base for future transport designs. Features include a high design Mach number and shock-free flow, as well as the minimization of the laminarization suction through a choice of airfoil geometry and pressure distribution. Two suction surface concepts and a variety of hybrid suction concepts involving combinations of natural and forced laminar flow are to be investigated. The test facility has been modified to insure achievement of required flow quality and transonic interference-free flow over the yawed LFC airfoil. D L G

A82-33348 Vertical takeoff technology - Flight mechanics, aerodynamics, and propulsion systems (Senkrechtstarttechnik - Flugmechanik, Aerodynamik, Antriebssysteme) X Hafer (Darmstadt, Technische Hochschule, Darmstadt, West Germany) and G Sachs (Munich, Hochschule der Bundeswehr, Munich, West Germany). Berlin, Springer-Verlag, 1982. 419 p 255 refs. In German. \$34.50.

An efficient solution of the problem of vertical takeoff for an aircraft is provided by the helicopter. However, with respect to cruising flight operations, the helicopter cannot compete economically with aircraft utilizing conventional takeoff. A special type of aircraft, often called 'powered lift aircraft', is needed to combine the facility of vertical takeoff with the economic cruising flight capabilities found in conventional aircraft. This book is exclusively concerned with the design problems regarding such powered lift aircraft. The book has the objective to present a survey of the development of vertical takeoff technology. It provides also a description of the various possible approaches for a technical solution of the involved problems, taking into account the basic relations of aerodynamics and flight mechanics which have to be considered for the design of systems that provide a vertical-takeoff capability. G R

A82-33387 † Aerodynamics Part 2 - Methods of aerodynamic design /3rd revised and enlarged edition/ (Aerodinamika. Part 2 - Metody aerodinamicheskogo rascheta /3rd revised and enlarged edition/). N. F. Krasnov, Moscow, Izdatel'stvo Vysshaya Shkola, 1980 416 p 53 refs In Russian

Methods for determining the aerodynamic characteristics of aircraft and aircraft components are discussed. Analysis is carried out for supersonic flow around pointed and blunt conical surfaces and thin-walled bodies of revolution at small angles of attack (linearized problems). Methods for calculating friction and heat transfer are examined. Attention is also given to the determination of aerodynamic parameters of aircraft for the combinations fuselage-wing and fuselage-wing-empennage (control surfaces) with allowance for interference effects. Finally, the aerodynamics of rarified gases is discussed. V. L.

A82-33514 # Downwash behind a wing with spanwise blowing. P. R. Kumar and E. G. Tulapurkara (Indian Institute of Technology, Madras, India) *Aeronautical Society of India, Journal*, vol 32, Feb -Nov 1980, p 105-108 7 refs

A theoretical estimate of downwash using Campbell's (1975) data on lift distributions on trapezoidal wings is presented. An indirect method is used to obtain circulation distributions, which are worked out for different values of the blowing coefficient using the vortex lattice method of Hedman (1966). Downwash behind the wing increases rapidly with increase in the blowing coefficient, and a value for the blowing coefficient is found for which the tail contribution to stability will be zero. Thus, the wing contribution to stability increases with blowing and the net decrease in stability is lower. D. L. G.

A82-33515 # Finite element analysis of some aerospace shell structures. S. Viswanath, S. S. Murthy, and C. G. Shah (National Aeronautical Laboratory, Bangalore, India) *Aeronautical Society of India, Journal*, vol 32, Feb -Nov 1980, p 109-115 9 refs

A computer program LINSHL is developed for the linear static analysis of stiffened shell structures. The program incorporates a high precision triangular cylindrical shell element, a high precision triangular shallow shell element, a curved beam element and a straight beam element. Numerical results are presented for the stress analysis of practical structures such as a ring-stiffened cylinder and a canopy hood of a typical aircraft, and are found to be in reasonable agreement with alternate solution methods. D. L. G.

A82-33520 # Design, fabrication and testing of an electrical analogue for heat transfer to coated turbine blade. P. R. Joshi and W. V. Nabar (Indian Institute of Technology, Bombay, India) *Aeronautical Society of India, Journal*, vol 32, Feb -Nov 1980, p 133-136

The analog method is described for the study of heat transfer to a coated solid turbine blade. The method is based on the fact that the governing equations for heat conduction in an isotropic, homogeneous nonheat-generating body under steady state conditions are the same as those governing the steady state distribution of electrical potential. The analog can be used to obtain the temperature distribution over the cross section of different blades coated or otherwise for various operating conditions. A schematic diagram of the electrical analog for heat transfer to a coated turbine blade is presented, and the design and fabrication of the analog is discussed. D. L. G.

A82-33523 # Primary sewage treatment plant as a source of bird hazards at airport. S. C. Pillai, M. K. C. Sridhar, and G. K. Viswanath (CIERS Research and Consultancy Private, Ltd., Bangalore, India) *Aeronautical Society of India, Journal*, vol 32, Feb -Nov 1980, p 149-153 8 refs

A82-33542 From the A 300 to the A 310 (De l'A 300 à l'A 310). R. Deque and D. Puyplat (Société Nationale Industrielle Aérospatiale, Division Avions, Paris, France) *L'Aéronautique et l'Astronautique*, no 93, 1982, p 3-18 In French

The subcontractor assignments and the evolutionary changes which produced the A 310 from the A 300 Airbus are described. Each subcontractor delivered parts in a maximal state of integration to the final assembly plant, which is intended to produce 8-10 aircraft/mo. The results of numerical modeling of the aerodynamic performance of the A 300 in subsonic/supersonic shock configurations led to a thickening of the wing near the root, in addition to a 16 percent reduction in total wing area, a 14 percent increase in wing length to reduce drag, and a higher cruising altitude. Composite materials were employed for the spoilers, airbrakes, the rudder, motor nacelles, etc., along with new, lightweight aluminum-zinc alloys for the longerons. Controls have been computerized and CRTs are in place in the cockpit instrument panel. Details of the instrumentation displays are provided. M. S. K.

A82-33543 The beginning of the ATR 42 program and its importance (Le lancement du programme ATR 42 et ses conséquences). A.

Ettesse (Société Nationale Industrielle Aérospatiale, Division Avions, Paris, France) *L'Aéronautique et l'Astronautique*, no 93, 1982, p 19-22 In French

Marketing and flight economy goals have led to the development of the ATR 42-100 and 42-200 dual turboprop aircraft for carrying 42 or 49 passengers 1300 or 1450 km, respectively. An increase in computer air traffic of 20-30 percent every year in France and 12 percent in the U.S. are cited as the driving force for the development of the new aircraft. The physical capabilities of the ATR are 15 tons weight, a flying range of 1350 km with 42 passengers, a cruise speed of 513 km/hr, an altitude of 13,400 ft on one motor, and a runway requirement of 900 m. The aircraft is a joint effort of the French and Italian governments, following an accord signed in 1980 to establish a common carrier. A P.W. 100/2 will initially power the plane until 1985, when a motor which allows the passenger number to increase to 50-60 will be introduced. M. S. K.

A82-33544 Aircraft lightning protection (Protection des aéronefs contre la foudre). J. Taillat (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) *L'Aéronautique et l'Astronautique*, no 93, 1982, p 37-52 40 refs In French

Currently known effects of lightning on aircraft and interior components are reviewed, along with measures which must be taken in order to make the broad use of composites acceptable in future aircraft. The types of accident lightning strikes have inflicted on USAF aircraft in the period 1970-1980 are examined, noting that catastrophic failures occurred due to damage to the control and navigation systems, electronics, and explosions of fuel or armaments. The introduction of increasing amounts of composite materials in the aircraft structures, parts which may cause resistance to the lightning path, and the use of electronic controls which can be degraded by electromagnetic pulses pose difficulties when the introduction of cost-saving measures is also life-endangering. The points of lightning attachment are examined, along with the effects on the aircraft components. It is recommended that composite parts be covered with a thin metallic film which conducts the current freely away from the composite, and that microelectronic circuitry be hardened against EMP. M. S. K.

A82-33547 Simulation reaches towards reality. D. Boyle *Interavia*, vol 37, May 1982, p 451-453

It is noted that the greatest progress is being made in the area of visual simulation, offering the possibility of considerable savings to airlines. The microcircuit has made it possible to develop computer-generated imagery (CGI) systems. A single simulator can provide a tremendous variety of airfield representations. Once the software has been developed for a given location, it can be furnished to many simulators by simply copying a tape or disk recording. A description is given of daylight CGI. C. R.

A82-33571 * Accurate numerical solution of compressible, linear stability equations. M. R. Malik (High Technology Corp., Hampton, VA), S. Chuang (George Washington University, Hampton, VA), and M. Y. Hussami (Institute for Computer Applications in Science and Engineering, Hampton, VA) *Zeitschrift für angewandte Mathematik und Physik*, vol 33, Mar 1982, p 189-201 12 refs. Contracts No NAS1-16572, No NAS1-14472, No NAS1-15810, Grant No NCCC1-14

The present investigation is concerned with a fourth order accurate finite difference method and its application to the study of the temporal and spatial stability of the three-dimensional compressible boundary layer flow on a swept wing. This method belongs to the class of compact two-point difference schemes discussed by White (1974) and Keller (1974). The method was apparently first used for solving the two-dimensional boundary layer equations. Attention is given to the governing equations, the solution technique, and the search for eigenvalues. A general purpose subroutine is employed for solving a block tridiagonal system of equations. The computer time can be reduced significantly by exploiting the special structure of two matrices. G. R.

A82-33605 * Diffraction by a finite strip. M. H. Williams (Purdue University, West Lafayette, IN) *Quarterly Journal of Mechanics and Applied Mathematics*, vol 35, Feb 1982, p 103-124 7 refs. Grant No NSG-3292

A new approach is presented to diffraction problems involving plane strip barriers or slit apertures. These are problems that display the effects of multiple interacting edges. The approach taken here provides exact, compact solutions. The theory is introduced through a series of examples that are, in fact, the 'standard' problems of the subject, diffraction of a plane oblique wave by a slit, for example. In each case, the solutions are found to depend explicitly on a single 'special' function and its Fourier transform. These fundamental functions are described, with the emphasis placed on practical computational methods. The example problems are all couched in the language of acoustics. C. R.

A82-33625 Understanding aircraft structures. J. Cutler. London, Granada Publishing, Ltd., 1981 176 p 11 refs \$22.75

After a brief account of the development history of aircraft structures from wire-braced systems to present semi-monocoque designs, attention is given to the terminology connected with flight, such as the pitch, yaw and roll axes, control, high lift devices, and aircraft shape and dimensions. An account is then

given of the nature and calculation of the loads to which aircraft are subjected by maneuvering and payload, and of the most common structural means that have been devised for the bearing of such loads. The design of wing boxes, fuselage tubes, and secondary structures is shown to be a decision process which entails the choosing of sheet, plate, forged or extruded forms of aluminum and titanium alloys, or reinforced plastics. Consideration must then be given to the processes by which the materials chosen will be assembled, along with the means of preventing corrosion of the resulting structure. Additional factors include the detailed design of structural components and fasteners, from the viewpoints of both weight-saving and cost-reduction criteria. Stress calculation methods and flightworthiness requirements are also covered. O C

A82-33626 # Wind tunnel studies of store separation with load factor - Freedrops and captive trajectories. J Coste and J Leynaert (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) *La Recherche Aéronautique* (English Edition), Jan-Feb 1982, p 1-9

Similitude conditions are considered for free-fall and captive trajectory store separation studies in wind tunnels, for the general case of in-flight separation with load factor. Three scaling laws, designated light, intermediate and heavy in keeping with test Mach number, were used in the store separation tests. Attention is given to the computer-controlled, six-degree-of-freedom rig which moves the store model incrementally in the aerodynamic field of the parent aircraft, taking into account the aerodynamic forces acting on the store at each point of its trajectory. Special arrangements are used to compensate for the fact that the method is only approximate, in that it does not take into account the relative speeds of store and aircraft. O C

A82-33627 # Model based study of various configurations of jet crossing a cavity - Application to the CEPRA 19 wind tunnel of CEPR. P Rebuffet and A Guédel (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) *La Recherche Aéronautique* (English Edition), Jan-Feb 1982, p 11-22 8 refs

A scale model study is conducted to determine the effects of varying the configuration of the crossing of an anechoic wind tunnel test chamber by a free jet, where the length of the jet and the dimensions of the diffuser inlet are varied. Attention is given to cavity resonances due to aeroacoustic coupling which were observed in some model configurations, as well as background noise measurements and the aerodynamic characteristics of both the jet and the reverse flow within the cavity. A collector compatible with 2-3 m diameter test sections is defined with a view to application to a new wind tunnel test facility. O C

A82-33628 # Potentiality assessment of a parallel structure for the solution of partial differential equations. J P Boisseau, M Enselme, D Guiraud, and P Leca (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) *La Recherche Aéronautique* (English Edition), Jan-Feb 1982, p 31-41 9 refs

An assessment is presented of the efficiency of a parallel-structure minicomputer system consisting of an AP 120 B array processor linked to a 32-bit SEL 32/77 host computer, using software representative of the intended applications: (1) the pseudo-unsteady method, for two- and three-dimensional flow computation, and (2) the pseudo-spectral time method, for the numerical simulation of turbulence. The analysis of test results distinguishes between processing time using the array processor, and transfer time between the memory and the computer unit. A possible compatibility between the hardware and the software algorithm used is investigated in the overlapping of the two characteristic times distinguished. O C

A82-33629 # Skin friction lines. R Legendre (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) *La Recherche Aéronautique* (English Edition), Jan-Feb 1982, p 43, 44

The conditions of rapid variation for properties of a viscous fluid flowing around a body are discussed, in order to determine whether the hypothesis of continuity is always justified either alone or in combination with Lighthill's (1963) additional hypothesis. The method employed uses singular points and lines which either pass through, originate or terminate at them. O C

A82-33630 # A new method for constructing two-dimensional orthogonal and non-orthogonal meshes. H Viviani (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) *La Recherche Aéronautique* (English Edition), Jan-Feb 1982, p 45-49

A novel and simple method is described for the construction of arbitrary domain orthogonal or nonorthogonal two-dimensional meshes, in which the integration of an ordinary differential equation directly yields mesh point Cartesian coordinates. Nozzle and airfoil profile flow examples are considered. O C

A82-33646 Aviation electronics /4th edition/. K W Bose Indianapolis, IN, Howard W Sams and Co, Inc., 1981 396 p \$17

Standard communication, navigation, and air traffic control systems are considered along with the aviation radio spectrum, and aircraft communication systems, taking into account rules for flight operations, the structure of the airways, termi-

nal facilities, en-route facilities, aspects of collision avoidance, radio waves and their effect at aviation frequencies, very-low frequencies, the low and medium aviation frequencies, the HF aviation bands, the VHF aviation bands, the UHF bands, aircraft antenna requirements, cockpit audio requirements, microphones and headsets, and transceivers. Other topics discussed are related to the VHF omnirange, navigation systems, instrument landing systems, automatic direction finders, distance-measuring equipment, radar beacon transponders, and weather radar. Attention is also given to gyroscopes and servo systems, flight directors and flight simulators, autopilots, design and reliability of solid-state avionics systems, shop facilities and regulations, and aircraft installations. G R

A82-33648 Essentials of aviation management /2nd edition/. J D Richardson (Appalachian State University, Boone, NC) Dubuque, IA, Kendall/Hunt Publishing Co., 1981 689 p 211 refs \$10.95

This book is intended to focus on the management of aviation businesses and to provide assistance to managers as they strive to overcome the problems of a rapidly changing and complex business environment. The contents of this book represent a mixture of generally accepted business procedures, practical 'how-to-do-it' material, applied research findings, sophisticated 'tools' and techniques as well as accepted history. A brief review is provided of aviation history and its impact upon the modern manager. Attention is given to management functions, profit orientation, business organization, regulatory impact, manpower management, physical facilities, operational activities, flight operations, aviation maintenance, marketing, problem administration, information systems, aspects of decision making, and the future for aviation business. G R

A82-33650 Gas turbine aero-thermodynamics with special reference to aircraft propulsion. F Whittle Oxford, Pergamon Press, 1981 273 p \$17.50

The fundamental principles and developments in aerothermodynamic theory and applications in aircraft propulsion gas turbine systems are detailed. Specific attention is given to the concepts of entropy and the isentropic expansion of a perfect gas. An analysis of the flux density and radial equilibrium in whirling isentropic compressible flows are presented, along with techniques for modeling shock waves in air, isentropic flow through nozzles, and the thermal cycles of perfect gases. Approximate methods for calculating gas turbine cycles are explored, as are the mass flow rate in gas turbines, the part load performance of gas generators, and combustion. Consideration is also given to turbojets, calculations of maximum efficiency, thrust boosting, turbofans, the effect of height and speed on performance, and to a numerical model of a super-thrust engine. M S K

A82-33657 * Airborne lidar measurements of the Soufriere eruption of 17 April 1979. W H Fuller, Jr., S Sokol (NASA, Langley Research Center, Hampton, VA), and W H Hunt (Wyle Laboratories, Hampton, VA) *Science*, vol 216, June 4, 1982, p 1113-1115 6 refs

At the time of the Soufriere, St Vincent, volcanic eruption of April 17, 1979, a NASA P-3 aircraft with an uplooking lidar (light detection and ranging) system onboard was airborne 130 kilometers east of the island. Lidar measurements of the fresh volcanic ash were made approximately 2 hours after the eruption, 120 kilometers to the northeast and east. On the evening of April 18, the airborne lidar, on a southerly flight track, detected significant amounts of stratospheric material in layers at 16, 17, 18, and 19.5 kilometers. These data, and measurements to the north on April 19, indicate that the volcanic plume penetrated the stratosphere to an altitude of about 20 kilometers and moved south during the first 48 hours after the eruption. (Author)

A82-33671 Aerodynamics: The science of air in motion /2nd edition/. J E Allen (British Aerospace Public, Ltd., Co., Kingston-upon-Thames, Surrey, England) New York, McGraw-Hill Book Co., London, Granada Publishing, Ltd., 1982 212 p 48 refs \$25

An anthology of aerodynamic concepts, theory, models of natural phenomena, and applications is presented. The development of aerodynamics visualizations and theory is traced from Newton's work on air resistance in 1726 to space flight and MHD modelling. The behavior of air in motion is examined, with consideration to various aspects of boundary layers, circulation, vortex flow, vorticity, and eddies. Main concepts employed in aerodynamic theory and experiments are listed, including physical constants and aerodynamic quantities such as the Reynolds number, Prandtl number, etc. Attention is given to natural phenomena such as wind flows, tornados, convective motion, and other meteorological occurrences, and the effects of terrain on the movements of the atmosphere. The extension of aerodynamic principles to the design of wind turbines and to aeronautics is explored and carried on to describe celestial objects and their behavior. M S K

A82-33701 Biennial Wind Energy Conference and Workshop, 5th, Washington, DC, October 5-7, 1981, Proceedings. ASME, Transactions, Journal of Solar Energy Engineering, vol 104, May 1982 74 p (For individual items see A82-33702 to A82-33712)

The results of studies funded by the Federal government to advance the state

of the art of wind energy conversion systems (WECS) construction, operation, applications, and financial viability are presented. The economics of WECS were considered in terms of applicable tax laws, computer simulations of net value of WECS to utilities, and the installation of Mod-2 2.5 MW and WTS-4 4MW wind turbines near Medicine Bow, WY to test the operation of two different large WECS on the same utility grid. Potential problems of increasing penetration of WECS-produced electricity on a utility grid were explored and remedies suggested. The structural dynamics of wind turbines were analyzed, along with means to predict potential noise pollution from large WECS, and to make blade fatigue life assessments. Finally, Darrieus rotor aerodynamics were investigated, as were dynamic stall in small WECS and lightning protection for wind turbines and components. M S K

A82-33707 # Effects of dynamic stall on SWECS. R B Noll (Aerospace Systems, Inc., Burlington, MA) and N D Ham (MIT, Cambridge, MA) (*Biennial Wind Energy Conference and Workshop, 5th, Washington, DC, Oct 5-7, 1981*) ASME, Transactions, Journal of Solar Energy Engineering, vol 104, May 1982, p 96-101 12 refs

A study of dynamic stall is presented in order to define its influence on the airfoil force and moment coefficients so that these effects can be included in the calculation of small wind energy conversion system (SWECS) loads and responses. A review of past work indicates that semiempirical methods are best suited to SWECS requirements. A definition of a dynamic stall theory is made for use in SWECS design, and the theory is implemented in SWECS loads and dynamic response analyses. Sample calculations are made for a representative vertical-axis machine. It is shown that loads and moments on the blades may be underestimated if dynamic stall is not considered. (Author)

A82-33708 # Darrieus rotor aerodynamics. P C Klimas (Sandia National Laboratory, Albuquerque, NM) (*Biennial Wind Energy Conference and Workshop, 5th, Washington, DC, Oct 5-7, 1981*) ASME, Transactions, Journal of Solar Energy Engineering, vol 104, May 1982, p 102-105 19 refs Contract No DE-AC04-76DP-00789

A summary of the progress of modeling the aerodynamic effects on the blades of a Darrieus wind turbine is presented. Interference is discussed in terms of blade/blade wake interaction and improvements in single and multiple stream tube models, of vortex simulations of blades and their wakes, and a hybrid momentum/vortex code to combine fast computation time with interference-describing capabilities. An empirical model has been developed for treating the properties of dynamic stall such as airfoil geometry, Reynolds number, reduced frequency, angle-of-attack, and Mach number. Pitching circulation has been subjected to simulation as potential flow about a two-dimensional flat plate, along with applications of the concepts of virtual camber and virtual incidence, with a cambered airfoil operating in a rectilinear flowfield. Finally, a need to develop a loading model suitable for nonsymmetrical blade sections is indicated, as well as blade behavior in a dynamic, curvilinear regime. M S K

A82-33750 The TM 333, a trump card for Turbomeca (Le TM 333, atout majeur de Turbomeca). J Morisset (*Air et Cosmos*, vol 20, May 8, 1982, p 13, 15-17 In French)

The new dual turbine, digital control TM 333 helicopter motor is described as having benefitted from a ten year program in basic aerodynamics, metallurgy, and electronics research. High compression, high expansions in reverse flow digitally controlled engines are coupled with improvements in the gear reductions and joints. The helicopter achieves program goals set in July 1979 of low operating cost, efficient fuel consumption over a broad power range, modular maintenance, fewer parts and lower purchase price, and low specific weight. The power plant furnishes a take-off impulse of 625 kW with a continuous output of 560 kW, with a fuel consumption of 318-330 gr/kWh. Specific performance features are listed and comparisons are made with turbines of other manufacturers. M S K

A82-33853 # The superalloys - Materials for gas turbine hot section components. J P Immargeon (National Aeronautical Establishment, Ottawa, Canada) (*Canadian Aeronautics and Space Institute, Annual General Meeting, 28th, Montreal, Canada, May 11, 1981*) Canadian Aeronautics and Space Journal, vol 27, Dec 1981, p 336-354 80 refs

Developments in materials technology for high temperature materials used in gas turbines are reviewed with emphasis on powder processing. Conditions under which turbine blades, vanes and disks operate are described, and material requirements for the three components are discussed. Advanced forming methods such as hot isostatic compaction of prealloyed powders and isothermal forging, and the rejuvenation of mechanical properties and subsequent recycling of used gas turbine components by hot isostatic pressing are considered. D L G

A82-33854 # Operational testing of the LN-33 inertial navigation system. M C Mendrisky (Canadian Forces, Air Navigation School, Winnipeg, Canada) (*Canadian Symposium on Navigation, 4th, Halifax, Canada, Nov 17, 1981*) Canadian Aeronautics and Space Journal, vol 27, Dec 1981, p 355-362

An evaluation was performed to determine the baseline performance of the LN-33 Inertial Navigation System (INS). Tests designed include determination of

geographic position accuracy in the pure inertial mode, determination of alignment quality, and the determination of a recommended time interval between system calibrations. Results of the navigation system testing on the Aurora, concentrating on the Doppler and Omega integrated operation of the INS, indicate that navigation will be more accurate in these modes of operation due to bounding effects and the fact that the INS itself performs better in this aircraft. D L G

A82-33855 # Mechanical and metallurgical considerations in extending the life of turbine blades. J Liburdy and J Wilson (*Canadian Aeronautics and Space Institute, Annual General Meeting, 28th, Montreal, Canada, May 11, 1981*) Canadian Aeronautics and Space Journal, vol 27, Dec 1981, p 363-374

Research supported by the National Research Council

The paper outlines a systematic approach to blade life extension. Methods of predicting blade life and establishing life trends are discussed, and methods of repairing typical airfoil damage on turbine blades are outlined with general guidelines on repair limits and the influence of dissimilar filler metals on stress patterns. As blades reach their critical life they may be rejuvenated using hot isostatic pressing and appropriate heat treatments. A mechanical analysis demonstrates that limited repairs are possible on physically damaged components, and at present, repairs using a weaker filler material are limited to the lower-stressed region of the blade, such as near the tip and on top of the shroud. D L G

A82-33891 # CDS grows new muscles. D P Raymer (Rockwell International Corp., Advanced Systems Design Dept., Los Angeles, CA) *Astronautics and Aeronautics*, vol 20, June 1982, p 22-31 5 refs

Recent improvements in the Configuration Development System (CDS) are discussed. Various design tasks that CDS can carry out are described, including fuselage development, wing and tail surfaces, initial structural design, fuel tanks and landing gear. New CDS abilities are also described, including the creation of command files, the modeling of existing designs for analysis or visualization, and doing on-line conceptual analysis of problems such as aerodynamic center and lift and moment derivatives, and friction drag. CDS can do tasks for which it was not specifically designed, and can perform any task that can be done on a drafting board. For the occasional user, CDS gives a productivity ratio of about four to one, while experienced users can expect an average improvement approaching ten to one. C D

A82-33892 # High technology raises fighter force readiness. R C Little, W P Murden, and R K Schaefer (McDonnell Douglas Corp., St Louis, MO) *Astronautics and Aeronautics*, vol 20, June 1982, p 38-45, 61

Evolutionary trends in U S tactical aircraft are discussed, emphasizing the role of high technology. The progressive increase in service life is accompanied by improved reliability. While digital technology in the aircraft has become more complex, there has been simplification in a number of areas, including electrical and plumbing connectors, hydraulic filters and lubrication points. Maintainability improvements include built-in test equipment and the Avionics Intermediate Shop, which uses automated test equipment to isolate a fault to an individual plug-in module. Though tactical aircraft potentially can fly two sorties per day, they are actually flying less than one. The problem derives from insufficient support services, and needed improvements are discussed in detail. C D

A82-33893 # The National Airspace System plan. J L Helms and S B Portzky (FAA, Washington, DC) *Astronautics and Aeronautics*, vol 20, June 1982, p 50-61

Major decisions, programs, and modernization plans of the National Airspace System are discussed. Greater cockpit control, automated weather observation systems, computerized ATC, and independent airborne Traffic Alert and Collision Avoidance Systems (TCAS) are anticipated. Near-term improvements include conflict-resolution advisories, en route metering, and improved terminal automation systems. The integration of traffic flow management and the use of TCAS are discussed in detail. Improved weather data will be obtained through the use of Doppler-radar technology, improved data bases, ground-based automated weather systems, and a central weather processor. The planned national airspace data interchange network will upgrade communications, and the Federal Radionavigation Plan will streamline navigation services. A modernized voice switching and control system, self-contained navigation systems, a microwave landing system, greater airport capacity, and facility consolidation are contemplated, and the plan as a whole is expected to be cost-effective. C D

A82-33904 Runway end intersection design. R W Hutchins (FAA, Albuquerque, NM) *Airport Forum*, Apr 1982, p 53-55

One of a number of airport design problems involves the design of runway intersections. Frequently the involved runways intersect near their physical ends, and additional design parameters have to be taken into account. While runway length requirements, construction cost, and land availability will probably be the dominant design considerations, significant improvements in safety, cost, and convenience can be achieved by the selection of a particular intersection configuration. The four basic types of multiple runway layouts are classified as parallel, crossing, 'open V', and 'closed V'. Attention is given to aspects of aviation safety,

ground traffic circulation, construction cost, capacity, the use of full runway length, and Navaid visual aid interference. A runway end intersection analysis is conducted, and the importance of taxiway access is discussed. G R

A82-33908 The next generation trainer. *Military Electronics/Countermeasures*, vol 8, May 1982, p 38, 40-42, 68

In connection with a number of drawbacks regarding the T-37 twinjet trainers currently being used and the age of these aircraft, the U S Air Force is considering the introduction of a fleet of modernized aircraft for use in training undergraduate pilots at Randolph Air Force Base, TX. The T-37 have been manufactured between 1955 and 1977. They lack pressurization for high-altitude training, modern ejection seats, and fuel-efficient engines. The four Next Generation Trainer (NGT) prototypes the Air Force is considering incorporate these and other updated features. The first delivery of 54 trainers is expected to be set for September 30, 1987, when the service life of the original T-37s expires. A description is presented of the major specifications and stage of development of each of the four NGT, giving attention also to the manufacturers' reasons as to why their individual NGTs should be purchased by the Air Force. G R

A82-33913 # The ubiquitous helicopter. A Gessow (Maryland, University, College Park, MD) *AIAA Student Journal*, vol 19, Winter 1981-1982, p 3-7, 48

The theory, aerodynamics, and operation of helicopters are outlined and the extension of current technology to future versions of the helicopter for various applications is anticipated. Differences between helicopter and fixed-wing aircraft flight and control are discussed, noting the greater difficulty in maintaining stability low speeds in gusty conditions with helicopters. Blade and hub advances are reducing the complexity of the blade articulation to the drive train and rotor weight and strength are being tightly controlled by the use of composite materials. The wide rotor diameter distributes loads over a large area, allows heavy cargo to be carried, and provides a gliding force during power-out descents. Various commercial and military applications are enumerated. M S K

A82-33914 # XV-15 - Foretelling things to come. L H Erb (Bell Helicopter Textron, Fort Worth, TX) *AIAA Student Journal*, vol 19, Winter 1981-1982, p 22-25

The development of workable configurations of tilt-rotor aircraft culminating in the XV-15 is traced. The aircraft take off with the rotors on either wing situated like those of a helicopter then tilt the blades forward to proceed with high-speed flight, which has to date been 300 kn maximum. The XV-15 proved that natural frequencies and aeroelasticity of the rotors and airframe could be combined in a stable system, and also reconfirmed the possibility of control in both helicopter and airplane modes, problems originally solved with the XV-3. Early applications for the craft are foreseen for offshore oil rigs and on destroyers and frigates of the Navy. M S K

A82-33915 # X-wing and the Navy V/STOL initiative. R M Williams (U S Defense Advanced Research Projects Agency, Arlington, VA) *AIAA Student Journal*, vol 19, Winter 1981-1982, p 26-34, 8 refs

The development of concepts for Navy use of sea control ships (SCS) which could take advantage of V/STOL aircraft capabilities in intensive combat situations is outlined. The X-wing aircraft is offered as a solution to basing antisubmarine warfare and sensor carrier aircraft on ships which are not intended as aircraft carriers, such as frigates and destroyers. Use of the VTOL aircraft would permit force projection beyond the radar horizon in the form of cruise and air-to-air missiles borne by the X-wing. Combining advances in circulation control/tandem wing aerodynamics, high stiffness composite materials, and shaft-moment-feedback/fly-by-wire controls, a craft with low disk loading became possible. The X-wing is powered by a turbofan, and pneumatic control allows elimination of blade cycle pitch, rotor blade articulation, flaps, slots, and ailerons. M S K

A82-33916 # Will ABC technology produce the next-generation helicopter. A W Linden (United Technologies Corp, Sikorsky Aircraft Div, Stratford, CT) *AIAA Student Journal*, vol 19, Winter 1981-1982, p 35-37

Design concepts developed in order to overcome the retreating-blade stall limitations on level air speed flight for helicopters are reviewed. Compound vehicles were tested to utilize the rotating blades' lift capabilities in hover and the fixed wings' high-speed flight capacity. Inherent instability and low power efficiencies ruled against the design, and dual, counter-rotating propellers were tried in an attempt to discard any need for lift on the retreating blade. The resulting XH-59A test aircraft has risen to over 25,000 ft, made 60 deg turns at 225 kn, and has exceeded 260 kn air speed. The blades are mounted without hinges or flexible elements, thus improving reliability, maintainability, and aircraft handling and controllability. M S K

A82-33920 # The U.S. airline industry - En route to deregulation. E Starkman (Dowling College, Oakdale, NY) *AIAA Student Journal*, vol 20, Spring 1982, p 30-36, 6 refs

The Airline Deregulation Act of 1978 and its consequences for the airline industry in the United States are discussed. The act is argued to have been a product both of public sentiment for reduced government regulation of private enterprise and the particular maturity of the airline industry, and it is noted that the actual deregulation act was preceded by a period of de facto selective deregulation beginning in 1977. Provisions of the act included the establishment of a fully competitive airline industry and the gradual dismantling, by January 1, 1985, of the Civil Aeronautics Board. Airlines have responded to the act by strengthening high-cost, long-haul routes at the expense of shorter routes while seeking to maintain feeder routes, in the case of the larger airlines, and explosive growth and the formation of entirely new carriers in the case of local service carriers. A L W

A82-33989 Formability of metallic materials - 2000 A.D.; Proceedings of the Symposium, Chicago, IL, June 24, 25, 1980. Symposium sponsored by the American Society for Testing and Materials. Edited by J R Newby (Armco, Inc., Middletown, OH) and B A Niemeier (Reynolds Metals Co., Richmond, VA). Philadelphia, PA, American Society for Testing and Materials (ASTM Special Technical Publication, No 753), 1982, 332 p \$39.50

Reports included in this volume provide a broad review of worldwide developments in forming metallic materials along with specifics for manufacturing and potential formability technologies. Papers are presented on the effect of aging on bulk formability of aluminum alloys, hot forming of aluminum-magnesium alloy sheet, application of formability assessment to autobody outer panels, and the influence of tooling temperature on the formability of stainless steel sheets. Other papers include material flow and defect formation in forging an airfoil shape from metal-matrix composites, the use of torsion testing to assess material formability, and computer-aided modeling of selected sheet metal forming processes. V L

A82-33994 Formability of INCOLOY alloy MA 956 - An oxide dispersion strengthened sheet alloy. M L Robinson (Inco Research and Development Center, Inc., Suffern, NY) and I Astley (Wiggin Alloys, Ltd., Hereford, England) In *Formability of metallic materials - 2000 A.D., Proceedings of the Symposium, Chicago, IL, June 24, 25, 1980*. Philadelphia, PA, American Society for Testing and Materials, 1982, p 147-158

The formability of INCOLOY alloy MA 956 (Fe - 19.5 wt% Cr - 4.5 wt% Al), designed for uses such as combustor components in gas turbine engines, has been evaluated using tension testing, cup testing, and strain analysis via the grid technique. An attempt has been made to interrelate the measured formability indexes utilizing relationships developed for conventional sheet alloys. It is concluded that although the alloy studied does not have the high degree of formability typical of conventional alloys, it does exhibit a usable degree of formability and can be formed into simple shapes. V L

A82-33995 Material flow and defect formation in forging an airfoil shape from metal-matrix composites. T Erturk (Middle East Technical University, Ankara, Turkey) and H A Kuhn (Pittsburgh, University, Pittsburgh, PA) In *Formability of metallic materials - 2000 A.D., Proceedings of the Symposium, Chicago, IL, June 24, 25, 1980*. Philadelphia, PA, American Society for Testing and Materials, 1982, p 176-188

Major defects that occur in the forging of a 2024 aluminum alloy matrix reinforced with 25 vol% 0.23-mm-diameter cold drawn bcc stainless steel wires are identified using compression tests on rectangular specimens. These defects include fiber shear failure and accompanying deviation from plane-strain, fiber/matrix interface decohesion and accompanying void formation, the occurrence of cracks at the convex surfaces of rectangular preforms in forgings involving bending, and nonuniformity in fiber distribution. Forming limit criteria for the prediction and the prevention of these defects are established, presenting the allowable stress states during forging and providing guidelines for the forging of airfoil shapes from rectangular preforms. V L

A82-33997 Low-speed aerodynamic characteristics of wings with sweep discontinuities. S M Ramachandra (Hindustan Aeronautics, Ltd., Design Bureau, Bangalore, India, Alfateh University, Tripoli, Libya) and S Prakash (Hindustan Aeronautics, Ltd., Bangalore, Indian Space Research Organization, Vikram Sarabhai Space Centre, Trivandrum, India) *Indian Academy of Sciences, Proceedings, Section C Engineering Sciences*, vol 4, Dec 1981, p 437-447, 15 refs

It is shown that, using the concept of a discrete vortex filament shedding, Weissinger's method can be modified to determine the span-wise loading for wings with a sweep discontinuity. The sweep discontinuity is modeled by the introduction of a discontinuity in the equivalent vortex pattern chosen to replace the wing. The total lift, induced drag, pitching moment coefficients and span-wise location of the center of pressure have been found for a few wing geometries using De Young and Harper's procedure. An increase in the outboard sweep shifts the maximum load position outboard besides decreasing the overall lift and induced drag coefficients. High suction peaks appear at the pivot. (Author)

A82-34007 * # A review of Reynolds number studies conducted in the Langley 0.3-m Transonic Cryogenic Tunnel. E J Ray (NASA, Langley Research Center, Hampton, VA) *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St Louis, MO, June 7-11, 1982, AIAA Paper 82-0941* 15 p 26 refs

Initial proof-of-concept results obtained in a pilot transonic tunnel, led to a U S decision to apply the cryogenic tunnel concept to the National Transonic Facility (NTF). The pilot tunnel was reclassified as a 'permanent' facility and renamed the 0.3-m Transonic Cryogenic Tunnel (TCT). The 0.3-m TCT, with its ability to operate at temperatures ranging from about 78 K to 340 K, combined with a 6 atmospheres pressure capability, provides extremely high test Reynolds numbers at relatively low model loading. In addition, the ability to vary pressure and temperature independently of Mach number provides a unique capability to conduct studies at a constant dynamic pressure or at a constant Reynolds number with just one model. Attention is given to the simulation of flight conditions, the cryogenic-pressure tunnel concept, the characteristics of the 0.3-m TCT, Reynolds number studies in the three-dimensional test section including a Space Shuttle study, and Reynolds number studies in the two-dimensional test section.

G R

A82-34008 * # Wing flap-type control effectiveness and effects of control hinge gap seals for a supercritical wing. E L Anglin and T A Byrdson (NASA, Langley Research Center, Hampton, VA) *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St Louis, MO, June 7-11, 1982, AIAA Paper 82-0960* 14 p 11 refs

Wind-tunnel tests were made to investigate the control effectiveness of wing trailing-edge flap-type aerodynamic controls for a supercritical wing. The tests determined the effects of spanwise flap control location, two different wing transition grit location patterns, magnitude of angular control deflection, control hinge moments and control hinge gap seals. Results show that the inboard flap position deflections caused interference rearward at the vertical tail, and that all flap positions for deflections in one direction only caused interference at the horizontal tail at a higher than design Mach number. Changes in wing transition grit pattern caused significant changes to static longitudinal characteristics and longitudinal control effectiveness.

D L G

A82-34101 * International aerospace review; Proceedings of the First International Aerospace Symposium, Le Bourget, Seine-Saint-Denis, France, June 2, 3, 1981. Symposium sponsored by the U S Department of Commerce, NASA, and U S Air Force. Edited by J Grey (American Institute of Aeronautics and Astronautics, New York, NY) and L A Hamdan (New York, American Institute of Aeronautics and Astronautics (AIAA Aerospace Assessment Series Volume 6), 1982 318 p Members, \$25, nonmembers, \$30

The status of aerospace industrial development in various countries is summarized, and specific areas of current and future progress are discussed. The first Shuttle astronauts recount details of the flight and performance of the initial Columbia mission and an attempt to assess the importance of the Shuttle as a milestone in transportation systems is presented. ESA space activities are reviewed, including the impact of space programs on European industries and employment. Attention is also given to Japanese and Chinese space programs. The evolution of communications satellites is traced and projections are made for near-term satellite requirements to be incorporated in the construction of Intelsat VI. Finally, advances in production of military jets and helicopters are considered, along with candidate alternate fuel systems to replace petroleum products.

M S K

A82-34108 # Military aircraft and international policy. B Revellin-Falcoz (Avions Marcel Dassault-Breguet Aviation, Vaucresson, Hauts-de-Seine, France) In *International aerospace review, Proceedings of the First International Aerospace Symposium, Le Bourget, Seine-Saint-Denis, France, June 2, 3, 1981* New York, American Institute of Aeronautics and Astronautics, 1982, p 107-112

The benefits to an aerospace company manufacturing aircraft which can be adapted to a variety of specific military uses are discussed. The practice is asserted to create production flexibility and increase sales by allowing a basic design to be reconfigured for different buyers and to the same buyer over a number of years. One drawback is that spare parts production must continue over the years for versions which are no longer produced, although some savings are realized in a commonality among different generations of the same aircraft. Sales are noted to be most favorably concluded through the use of a prime contractor who controls all details of a deal, while still answering to the demands and suggestions of all partners and parties involved. Finally, it is mentioned that weapons exports make up for one-quarter of the national cashflow which leaves France for purchases of oil.

M S K

A82-34109 # Commercial transport developments for the 1980's. J E Steiner (Boeing Co., Seattle, WA) In *International aerospace review, Proceed-*

ings of the First International Aerospace Symposium, Le Bourget, Seine-Saint-Denis, France, June 2, 3, 1981 New York, American Institute of Aeronautics and Astronautics, 1982, p 115-139

A review is presented of the technology currently incorporated into modern air transportation vehicles and trends for the future are discussed. Reducing fuel consumption has led to the adoption of the high-bypass ratio turbofan, which has also provided significant noise reduction. Wings are being designed with less sweep in order to be more fuel efficient, and combined with new airfoil configurations and fuel-efficient cruise speeds. The commonality of solutions to efficiency problems has led to increasing homogeneity in the design, structure, and components of aircraft built by different manufacturers. Equipment which is not cost-effective tends to be grounded as soon as possible, with new aircraft operating at 40-60% economic improvement over previous generations. A shift to smaller, commuter aircraft is foreseen, along with composite primary structures, full-scale active controls, and a reduction in wing and tail sizes.

M S K

A82-34110 # Military aircraft - The way ahead. D Smallwood (British Aerospace Public, Ltd., Co., Weybridge, Surrey, England) In *International aerospace review, Proceedings of the First International Aerospace Symposium, Le Bourget, Seine-Saint-Denis, France, June 2, 3, 1981* (A82-34101 16-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 141-147

Performance and mission requirements for present and future combat aircraft are explored, with a focus on NATO forces in central Europe. Survivability of the aircraft is stressed, particularly in scenarios where airfields have little chance of remaining intact, which is seen as a driving force for near-term operational capability for V/STOL aircraft. Additional necessities for all-weather and climatic conditions operations are listed in addition to nighttime performance ability in all combat modes. Improvements are likely to be forthcoming in the area of composite structures, higher performance engines, and continued automation of avionics and weapons systems, as well higher-resolution radars and task integration in the digitized cockpit avionics displays.

M S K

A82-34111 # The military helicopter market today and tomorrow. D O Smith (United Technologies Corp., Sikorsky Aircraft Div., Stratford, CT) In *International aerospace review, Proceedings of the First International Aerospace Symposium, Le Bourget, Seine-Saint-Denis, France, June 2, 3, 1981* New York, American Institute of Aeronautics and Astronautics, 1982, p 149-153

Demands and the status of the present world helicopter market are discussed with an emphasis on military applications. Approximately 29,300 units are expected to be sold in the period 1981-1990, with a total price tag of \$29.2 billion, not counting spare parts. Currently, the Sikorsky Black Hawk is being employed by the U S Army for carrying combat troops and equipment, while the UH-60A is used as a cargo transport with a capacity of 4 tons. Attack, surveillance, and mine laying are other functions assigned to military helicopters. Development of new helicopters in the U S is noted to take seven years, and an estimated 3% of all U S helicopters are now over 15 yr old.

M S K

A82-34112 # Development of an aircraft engine. J Calmon (SNECMA, Paris, France) In *International aerospace review, Proceedings of the First International Aerospace Symposium, Le Bourget, Seine-Saint-Denis, France, June 2, 3, 1981* New York, American Institute of Aeronautics and Astronautics, 1982, p 155-163

The evolution of designs in jet engines, requirements which lead to the incorporation of modifications and improvements, and the cooperation between companies to produce the engines are considered in terms of the development of a currently available GE engine. The TF 39 was certified in 1968 for the C5A, experienced a modification in the low-pressure section for use in the DC 10-10, and underwent further changes to be employed in the DC 10-30, A300, and 747, becoming the CF6-50 along the way. The CF6-80 is the next step and will feature a shorter combustion chamber and no turbine midframe. Increasing the fan diameter augments the thrust, and it is noted that 60,000 test hours have accrued on the engine up to 1981. Development, production, and product support for the CFM56 engine is shared 50-50 between GE and SNECMA, and features new materials and electronic fuel control to obtain increased fuel efficiencies.

M S K

A82-34113 # Solutions to the aviation fuel problem. W M Hawkins (Lockheed Aircraft Corp., Burbank, CA) In *International aerospace review, Proceedings of the First International Aerospace Symposium, Le Bourget, Seine-Saint-Denis, France, June 2, 3, 1981* New York, American Institute of Aeronautics and Astronautics, 1982, p 165-180

Projections of the duration of availability of petroleum-derived jet fuels are reviewed and candidates for alternative fuels are discussed. World production of crude oil is expected to begin to irreversibly decline in the 1990s, and the design of new aircraft which could use alternative fuels is noted to depend strongly on the new fuels which have yet to be chosen. Any new fuel supply will be required to have a low producibility cost, be continuously replenishable, be available for multiple uses, be easy to handle and transport, safe to use, cause no major changes in equipment, and be minimally polluting. An additional consideration is

that the fuel could be derived where used to avoid the political problems inherent in current fuel supplies. Liquid hydrogen is found to be the best solution because of light weight, water as the source, available everywhere, and costs less than shale or coal-derived fuels. M S K

A82-34114 # Aeronautical research and development. P. Poisson-Quinton (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) In International aerospace review, Proceedings of the First International Aerospace Symposium, Le Bourget, Seine-Saint-Denis, France, June 2, 3, 1981.

New York, American Institute of Aeronautics and Astronautics, 1982, p 181-205. 7 refs.

Aerospace research and development is examined in terms of its role in progress, the necessity for industry, government, and user cooperation, the functions of ONERA, and research results which are beginning to pay off. Research is being channeled by advances in electronics and computer abilities, and balances are needed between basic and applied research funding. Government programs are noted to specifically center around risky and/or long term research, while industry concentrates its efforts on near-term evolutionary studies. ONERA research departments are reviewed, along with outlines of wing fabrication development techniques, the transonic propeller, and a carbon fiber wing. The development of active control systems has resulted in increased fuel efficiencies. The interactions between AGARD, ONERA, NASA, and GARTEUR are outlined. M S K

A82-34120 # Technical trends in the civil aircraft and helicopter industry. R. Chevalier (Société Nationale Industrielle Aérospatiale, Paris, France) In International aerospace review, Proceedings of the First International Aerospace Symposium, Le Bourget, Seine-Saint-Denis, France, June 2, 3, 1981.

New York, American Institute of Aeronautics and Astronautics, 1982, p 263-273.

Technical prospects for improvements in aerodynamics, weight savings, propulsion, and navigational systems in the civil air transportation industry in the next two decades are projected. Aerodynamics will encounter more wing-span for efficiency, decreased wing sweep for better low-speed control, and thicker airfoils for improved fuel efficiency. Composites and structures modeled by computer are foreseen as contributing to 15-26 percent in weight savings by the year 2000. The families of future engines include the introduction of high temperature and compression ratio turbofans and turboprops, in addition to propfans, which feature high efficiency at speeds of Mach 0.7 and above. Microminiaturization of electronics is expected to produce another order of weight reduction equal to that already achieved, in addition to improved safety, handling qualities, and control. Greater use of civil helicopters and supersonic transport is predicted. M S K

A82-34121 # Military aircraft. H. F. Rogers (General Dynamics Corp., St. Louis, MO) In International aerospace review, Proceedings of the First International Aerospace Symposium, Le Bourget, Seine-Saint-Denis, France, June 2, 3, 1981.

New York, American Institute of Aeronautics and Astronautics, 1982, p 275-290.

Even though the emergence of sustained supersonic cruise and maneuvering as a useful tactical tool is foreseen, no significant expansion of the current operational envelopes of fighters is now in prospect. Maximum speeds at altitude will be in the Mach 2.0-2.2 region, and maximum speeds at sea level will not significantly deviate from the current value of Mach 1.2. Two important uncertainties in the air-to-air arena are (1) positive, all-weather, beyond-visual-range identification and (2) warning and control in a high-density environment. In designing aircraft, the need for realistic requirements, balancing unit (aircraft) effectiveness against total force effectiveness, is stressed. Also considered important is the use of hybrid technology, that is, the careful integration across classic technological disciplines to achieve enhanced operational capability with a more efficient solution. A third requirement is a modular design approach. C R

A82-34123 # Business jets to agricultural aircraft - An overview of general aviation. J. H. Winant (National Business Aircraft Association, Washington, DC) In International aerospace review, Proceedings of the First International Aerospace Symposium, Le Bourget, Seine-Saint-Denis, France, June 2, 3, 1981.

New York, American Institute of Aeronautics and Astronautics, 1982, p 295-300.

Attention is given to the inroads that have been made in the American market by foreign firms. In the turboprop field, which is seen as the area of strongest potential growth in the years immediately ahead, the United States continues to dominate. Attention is also given to the technological importance of business aircraft. The traditional technological spinoff roles appear to be reversing themselves, business aircraft, for so many years inheritors of design concepts born in the military and air transport aircraft industries, are now moving into the position of being the source for significant innovation. Three important technological challenges seen in business aviation are the problem of noise, the need to make aircraft lighter and more slippery, and the development of alternative fuels. C R

A82-34125 Fatigue life prediction of helicopter pitch link using Kaman life calculation methods. C. P. Hardersen (Kaman Aerospace Corp.,

Bloomfield, CT) *American Helicopter Society, Specialists Meeting on Helicopter Fatigue Methodology*, St. Louis, MO, Mar 1980, Paper 12 p.

This paper uses information supplied by the Army to arrive at a final calculated life for a pitch link component. Discussions are presented on the handling of strength data, load data, and frequency data in the context of a fatigue life computer program. Load and strength are presented as statistics which are randomly combined using Monte Carlo techniques. Improvements in technique could include the consideration of statistical variation on mission, statistical consideration of multi-mode failures, and improved cycle-by-cycle evaluation techniques. (Author)

A82-34127 † Periodic boundary value problem for the equations of the harmonic oscillation of a rotor blade about the axis of a flapping hinge (Periodicheskaia kraevaya zadacha dlia uravnenia garmonicheskikh kolebaniy lopasti nesushchego vinta otnositel'no osi gorizontalnogo sharnira). V. S. Vozhdaev. *TsAGI, Uchenye Zapiski*, vol 12, no 4, 1981, p 9-18. 5 refs. In Russian.

The numerical calculation of the aerodynamics of a hinged rotor in an oblique flow in terms of blade theory is examined. It is shown that the transformation of the system of coupling equations and equations of the flywheel motion of the blade in blade theory into a system of coupling equations leads to an equation for harmonic oscillations with periodic boundary conditions. A solution to the problem is found in integral form, allowing the solution of the corresponding difference equation expressed in terms of Chebyshev polynomials and related mixed polynomials. The differential equation of flywheel motion is then transformed into the form of an integral Fredholm equation of the second kind.

A L W

A82-34128 † Finite element calculation of the aerodynamic forces on a vibrating wing in supersonic flow (Raschet metodom konechnykh elementov aerodinamicheskikh sil na koleblushchemsia kryle v sverkhzvukovom potoke). V. G. Bun'kov. *TsAGI, Uchenye Zapiski*, vol 12, no 4, 1981, p 19-26. In Russian.

A finite element method is used to calculate the aerodynamic forces on a thin wing with supersonic trailing edges. Velocity potential and deformations are determined for a wing partitioned into both trapezoidal and triangular finite elements by the use of a matrix of aerodynamic influence coefficients expressing the effects of pressure differences on each node. Results of calculations are presented which demonstrate the effects of the Mach and Strouhal numbers on flutter characteristics.

A L W

A82-34132 † Similarity parameters for the geometric structure of a supersonic jet propagating in a channel and in a submerged space (Parametry podobia geometricheskoi struktury sverkhzvukovoi strui, rasprostraniushchiesia v kanale i zatoplennom prostranstve). E. A. Leites. *TsAGI, Uchenye Zapiski*, vol 12, no 4, 1981, p 54-63. 14 refs. In Russian.

An approximate method is used to determine the linear length scales of a jet propagating in a cylindrical channel or a submerged space. The method is based on a linearization of the differential equations of motion for an inviscid compressible, nonheat-conducting perfect fluid a sufficient distance from the nozzle exit to obtain a relation between the longitudinal and transverse length scales. The analytical relations obtained are shown to be in agreement with experimental data and the results of numerical studies for a wide range of flow parameters for axisymmetric and plane jets.

A L W

A82-34135 † Temperature fields in three-layer panels with a honeycomb filler during unsteady heating (Temperaturnye polia v trekhslonnykh paneliakh s sotovym zapolnitem pri nestatsionarnom nagreve). S. N. Ivanov and M. A. Morozov. *TsAGI, Uchenye Zapiski*, vol 12, no 4, 1981, p 97-104. 5 refs. In Russian.

The unsteady temperature fields in a three-layer panel with a honeycomb filler are calculated by an approximate method. Equations for heat balance in elements of the filler and sheathings with temperature-dependent thermophysical properties were solved under conditions of unsteady nonuniform heating, with the effective thermal conductivity of the filler in a direction parallel to the sheathing determined taking into account both conductive and radiative heat transfer along the honeycombs. Calculated temperature distributions are compared with those measured for the upper and lower sheathings of a three-layer panel with and without edge ribs heated along a narrow band of the center section to temperatures of up to 800 C to demonstrate the validity of the approach.

A L W

A82-34136 † Detached flow past V-shaped low-aspect-ratio wings (Otryvnoe obtekanie V-obraznykh kryl'ev malogo udlineniia). S. K. Betaev, M. I. Grigor'ev, and G. G. Sudakov. *TsAGI, Uchenye Zapiski*, vol 12, no 4, 1981, p 105-109. 8 refs. In Russian.

The aerodynamic characteristics of a V-shaped wing are investigated theoretically and experimentally as a function of wing dihedral angle. Experiments were performed with a wing model with a sweep of 80 deg and dihedral angles from 0 to 40 deg attached to a conical body at angles of attack from -5 to 16 deg and free-stream Mach numbers of 0.6 and 1.1. Theoretical calculations were carried

out for an isolated V-shaped delta wing of negligible thickness in terms of slender body theory, which allowed the three-dimensional problem of detached flow to be reduced to the unsteady two-dimensional problem of detached flow around a widening V-shaped plate. Lift coefficients derived from the calculations and from pressure measurements show a maximum at negative dihedral angles, indicating that the parachute effect is a consequence of nonlinear effects arising from flow separation from the lateral edges of the wing. A L W

A82-34144 † **Development of a control law for the alleviation of maneuver loads on an elastic aircraft (Postroenie zakona upravleniia dlia snizheniia manevrennykh nagruzok na uprugom samoete).** F Z Ishmuratov and V N Popovskii. *TsAGI, Uchenye Zapiski*, vol 12, no 4, 1981, p 156-161 5 refs. In Russian

A mathematical model for the longitudinal maneuver of an elastic aircraft is used to develop an active control system for the reduction of maneuver loads. This rather general model makes it possible to investigate the interaction of the active control system with the motion of the aircraft (as a rigid body) and with elastic deformations of the structure under large disturbances. As an example, this approach is used to investigate the longitudinal maneuver of a heavy passenger aircraft with swept wings of large aspect ratio. B J

A82-34145 † **Structural optimization of a swept wing on the basis of the aileron efficiency condition (Optimizatsiia konstruktii strelovidnogo kryla iz usloviia effektivnosti eleronov).** V I Biriuk, A V Sharanuk, and Iu F Iaremchuk. *TsAGI, Uchenye Zapiski*, vol 12, no 4, 1981, p 162-166 5 refs. In Russian

The paper considers the maximization of the aileron efficiency of a swept wing of large aspect ratio and specified weight by means of the optimization of the distribution of stiffness characteristics. The wing is modeled as a beam, and constraints imposed on the stiffness characteristics are taken into account. It is shown that an increase of approximately 20% can be obtained in the aileron efficiency by optimization of the stiffness distribution (the initial weight being preserved). B J

A82-34149 † **An experimental study at free-stream Mach 5 of the aerodynamic heating of the upper surface of plane wings of various planforms (Eksperimental'noe issledovanie pri chisle M sub infinity 5 aerodinamicheskogo nagrevaniia verkhnei poverkhnosti ploskikh kryl'ev razlichnoi formy v plane).** N A Kovaleva and A Ia Iushin. *TsAGI, Uchenye Zapiski*, vol 12, no 5, 1981, p 23-32 14 refs. In Russian

Heat transfer at the upper surface of the wing has been investigated for plane wings of seven different planforms at a free-stream Mach number of 5, with angles of attack varying from 0 to 15 degrees. A Reynolds number of $(1.7-2.5) \times 10^6$ has been computed from incoming free-stream flow parameters and the model length. Heat transfer at the upper wing surface is found to be strongly dependent on the shape of the wing leading edge. V L

A82-34154 † **Determination of the glide path of an aircraft with power off (Opredelenie oblasti dostizhimosti letatel'nogo apparata bez tiagi).** G V Parysheva, S A Smirnov, and V A Iaroshevskii. *TsAGI, Uchenye Zapiski*, vol 12, no 5, 1981, p 72-83. In Russian

The glide path of an aircraft controlled by varying the angle of roll is analyzed in terms of a quasi-stationary gliding hypothesis. The Pontryagin maximum principle is used to determine the angle-of-roll control structure at trajectories corresponding to the glide path boundaries, and a classification of such trajectories is proposed. Glide paths are plotted for an aircraft as a function of its maneuvering capabilities, i.e., the available distance and the available angle of turn. V L

A82-34157 † **Hysteresis of the normal force of a wing of complex planform under unsteady motion (Gisteresis normal'noi sily kryla slozhnoi formy v plane pri neustanovivshemsia dvizhenii).** A N Zhuk, A I Kur'ianov, and G I Stoliarov. *TsAGI, Uchenye Zapiski*, vol 12, no 5, 1981, p 113-118. In Russian

The effect of unsteady motion on the normal force of an aircraft having a wing of complex planform has been investigated at subsonic velocities. It is found that noticeable transformation of aerodynamic characteristics occurs, in relation to angles of attack, at separation regimes in the case of unsteady motion. It is also found that the hysteresis loop in the normal force vs angle of attack relationship widens with the angular frequency of oscillations. This effect is attributed to transformations in the unstable vortex structure of flows at large angles of attack and to the irreversibility of viscous separated flows. V L

A82-34161 † **An algorithm for calculating the compliance matrices of aircraft structures by the substructure method as applied to aeroelasticity problems (Algoritm rascheta matrits podatlivosti konstruktii letatel'nykh apparatov metodom podkonstruktii primenitel'no k zadacham aerouprugosti).** D D Evseev and A A Rybakov. *TsAGI, Uchenye Zapiski*, vol 12, no 5, 1981, p 139-142. In Russian

An algorithm based on a polynomial method is proposed for determining the compliance matrices of aircraft structures. An aircraft is represented as a set of flexible substructures (wing, fuselage, controls, and suspensions) with independent sets of coordinate functions used for specifying substructure deformations. Coupling between the substructures is realized by means of discrete springs simulating actual connections between structural elements. V L

A82-34162 † **Method for the measurement of elastic deformations of aircraft models in a wind tunnel (Sposob izmereniia uprugikh deformatsii modeli samoleta v aerodinamicheskoi trube).** M V Ushakov. *TsAGI, Uchenye Zapiski*, vol 12, no 5, 1981, p 143-147 8 refs. In Russian

The measurement of the surface deformations of an aircraft model in a wind tunnel flow by a remote optical method is presented. A series of mirrors was attached flush with the wing and elevon surfaces of the model at 59 separate points, and illuminated with laser light which was subsequently reflected onto a screen. Chordwise and spanwise deformations were calculated from the differences of the positions of reflected spots for the situations of deflected and nondeflected control surfaces at an angle of attack of zero and Mach number of 2. Experimental measurements of the angle of deformation are observed to be in good agreement with those calculated from piston theory, supporting the applicability of the optical method in similar experiments. A L W

A82-34163 † **Instability effects on pylon and engine loading in an aircraft with high-aspect-ratio wings (Vliianie nestatsionarnosti na nagruzhenie pilonov i dvigatelei samoleta s krylom bol'shogo udlineniia).** G I Turchanikov. *TsAGI, Uchenye Zapiski*, vol 12, no 5, 1981, p 148-152. In Russian

Consideration is given to the problem of the dynamic loading of the pylons and engines of an aircraft with high-aspect-ratio wings flying in the turbulent atmosphere. In contrast to previous analyses based on a quasi-steady approach to the determination of the aerodynamic forces acting on an elastically deforming aircraft flying in the downwash field of a harmonic gust, the present analysis takes into account the unsteady variations in aerodynamic forces. Results of calculations of dynamic loading are presented for a heavy transport aircraft with two engines under each wing flying at an altitude of 6 km at Mach 0.77 with normal loading. It is noted that the present method results in the reduction of calculated pylon loadings to a level acceptable for maintaining static stability. A L W

A82-34166 † **Transonic flow past bodies of the type wing-fuselage with allowance for boundary effects (Transzvukovoe obtekanie tel tipa krylo-fuzeliakh s ucheto vlianiia granits potoka).** I V Tret'akova and A S Fonarev. *TsAGI, Uchenye Zapiski*, vol 12, no 6, 1981, p 9-15 8 refs. In Russian

Transonic flow past bodies of the type wing-fuselage is analyzed in the case of unbounded flow and in the case of gas flow inside a cylindrical wind tunnel with permeable boundaries. A numerical analysis is used to determine the effect of the walls of the wind tunnel test section on flow past the model. It is shown that the effect of the walls on flow past the model can be significantly reduced by adjusting pressure in the wind tunnel external chamber. V L

A82-34172 † **Solution of creep problems by a finite element method (Reshenie zadach polzuchesti metodom konechnykh elementov).** G N Zamula and V A Pavlov. *TsAGI, Uchenye Zapiski*, vol 12, no 6, 1981, p 87-97 5 refs. In Russian

A method and a computation algorithm based on the use of finite elements are used to analyze the stress-strain state of thin-walled aircraft structures. The method and the algorithm, implemented in a computer program, are tested on several problems including a problem concerning thermal relaxation in a stiffened plate which has exact (viscoelasticity case) and numerical (nonlinear creep) solutions. In both cases, the results obtained are in good agreement with those reported by other workers. V L

A82-34177 † **A method of accounting for the effect of aircraft deformations on its loading (Metod ucheta vlianiia deformatsii samoleta na ego nagruzhenie).** V Ia Mitrushchenkov. *TsAGI, Uchenye Zapiski*, vol 12, no 6, 1981, p 124-130. 5 refs. In Russian

A method is proposed for solving static aeroelasticity problems whereby structure deformation is expanded in terms of deformation forms obtained by the method of successive approximations. The convergence of the method is analyzed with reference to a problem concerning the loading and stress-strain state of an aircraft structure with allowance for the effect of deformations on aerodynamic force distribution. Numerical results are presented. V L

A82-34359 * **Linear decentralized systems with special structure.** C F Martin (Case Western Reserve University, Cleveland, OH). *International Journal of Control*, vol 35, Feb 1982, p 291-308 5 refs. Grants No. NSG-2384, No. NAG2-82, Contracts No. N00014-80-C-0199, No. DE-AC01-80RA-5256

Certain fundamental structures associated with linear systems having internal

symmetries are outlined. It is shown that the theory of finite-dimensional algebras and their representations are closely related to such systems. It is also demonstrated that certain problems in the decentralized control of symmetric systems are equivalent to long-standing problems of linear systems theory. Even though the structure imposed arose in considering the problems of twin-lift helicopters, any large system composed of several identical intercoupled control systems can be modeled by a linear system that satisfies the constraints imposed. Internal symmetry can be exploited to yield new system-theoretic invariants and a better understanding of the way in which the underlying structure affects overall system performance. C R

A82-34373 # Electro-hydraulic nose wheel steering of the Dornier 228. Dornier-Post (English Edition), no 2, 1982, p 60, 61

The construction, control, and electronics for the electrohydraulic nose wheel steering of the Dornier 228 aircraft are described. The pilot steers with pressure on the pedal, which changes the rudder position at the same time. The alteration of pedal position initiates voltage signals from a command potentiometer, signals which move into a servo-channel and a monitor channel. Actual nose wheel deflections are recorded by a feedback sensor for comparison between input and output signals. Steering is limited to 18 deg/sec with maximum deflection set at 45 deg either way during taxiing, 8 deg during take-off, and 0 deg during take-off and landing. An error threshold is included in the control logic, resulting in steering actuator deactivation if the difference between command and feedback signals exceeds the specified level. M S K

A82-34374 # OLGA - A gust alleviation for general aviation aircraft. H Bjhrer. Dornier-Post (English Edition), no 2, 1982, p 62-64

Open-loop gust alleviation (OLGA) is described as a method of avoiding the 0.3 Hz gust induced vibrations which are associated with the maximum occurrences of sickness, particularly in low-flying, short haul aircraft. Closed-loop systems measure the magnitude of response to gusts and change control surface configurations to compensate. This is noted to cause sluggish response to pilot commands by altering the flight characteristics. In the new technology wing program, symmetrical aileron deflection and horizontal stabilizer changes are actuated from signals generated by a digital control unit which senses the gust angle of attack, then commands compensatory action. The pilot has complete override control. Block diagrams are provided of the control circuitry, and it is shown that OLGA can produce approximately 75% gust alleviation in the ranges 0.3-0.9 Hz. M S K

A82-34397 On the torsional modes of a uniformly tapered solid wing. E H Mansfield (Royal Aircraft Establishment, Farnborough, Hants, England). *Aeronautical Quarterly*, vol 33, May 1982, p 154-173

An exact analysis is first given, within the spirit of elementary theory, of the torsional modes of a uniformly tapered solid wing whose section shape - as distinct from size - is constant. Numerical results are presented for the first five torsional modes for various values of tip chord/root chord. It is shown that the frequencies are fairly insensitive to the magnitude of the taper, and a corollary to this, which is also investigated, is that an analysis based on a partially stepped representation of the taper yields close estimates of the frequencies but can yield massive differences in the higher mode shapes. An analysis is also made of warping restraint and distributed inertia effects. (Author)

A82-34398 Turbulent boundary-layer development on a two-dimensional aerofoil with supercritical flow at low Reynolds number. C J Baker and L C Squire (Cambridge University, Cambridge, England). *Aeronautical Quarterly*, vol 33, May 1982, p 174-198. 15 refs. Research supported by Rolls-Royce, Ltd.

Measurements of boundary-layer development on a small two-dimensional airfoil at turbomachinery scale Reynolds numbers with turbomachinery-type pressure distributions, supercritical flow and a weak shock front are presented in addition to measurements on the tunnel side wall opposite the airfoil surface. Three boundary-layer calculation methods are considered, and none are regarded as adequate for predicting all regions of boundary-layer development on both the airfoil surface and tunnel. The lag-entrainment method of Green et al (1973) however, is satisfactory for most purposes on the airfoil. Experimental results are compared with those results from several calculation methods. D L G

A82-34464 † Automation of the synthesis of control in a stationary linear system (Avtomatizatsiya sinteza upravleniya v statsionarnoi lineinoi sisteme). V L Zagaichuk. *Priborostroneniye*, vol 25, Apr 1982, p 21-24. 5 refs. In Russian.

A method for determining the feedback law for the accuracy optimization of a stationary linear system is presented. A block-diagram for the digital-computer calculation of the parameters of the corresponding optimal controller is presented, and application to a particular case of aircraft flight control is considered as an example. B J

A82-34486 Unistructure - A new concept for light weight integrally stiffened skin structure. D J Brimm (Chem-Tronics, Inc., El Cajon, CA)

Aircraft Engineering, vol 54, Apr 1982, p 2-8

Unistructure is a new concept for lightweight integral rib-reinforced skin structures that is readily adaptable to many configurations. The rib cross sections are a form of I beam. The rib reinforcing patterns considered here are isogrid and waffle, (i.e. triangular and rectangular constructions) but any desirable form can be produced. This paper provides an over-view of the methods of fabrication and the structural performance features of Unistructure. Comparisons are made with honeycomb, skin/stringer, and integral-machined structures. These comparisons indicate that the combined ease-of-fabrication and performance advantages of Unistructure warrant its consideration in many applications. (Author)

A82-34491 # Trends in structural analysis at ONERA (Tendances actuelles en calcul des structures à l'ONERA). R Valid (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). *Journées sur les Tendances Actuelles en Calcul de Structures, 2nd, Sophia-Antipolis, Alpes-Maritimes, France, Feb 1-3, 1982* ONERA, TP no 1982-2, 1982. 46 p. 100 refs. In French.

Research directions for modeling phenomena of structural interactions, fluid-structure interactions, the behavior of composite structures, and in aerospace structures are discussed. Increasingly precise predictions are necessary for successful numerical simulation of stress cracking, impact damage, wing-flow interactions, elastoacoustic resonance, aeroelastic optimization, hydroelasticity, the elimination of the pogo effect, elasto-capillarity in orbiting spacecraft, trajectory deformation, the homogeneity of stiffened structures, etc. Analytical tools in the process of development comprise applications of variational principles and their coupling in static and dynamic situations, finite element modeling of multilayered composites under displacement, and isoparametric finite elements for composites with layers under rotation. Variational formulations and symmetric operators are employed in hydroelastic, elastoacoustic, and elasto-capillarity, particularly in coupling modes. M S K

A82-34493 # Flow visualization techniques for the study of high incidence aerodynamics. H Werlé (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). *(NATO, AGARD, Lecture Series on Study of High Incidence Aerodynamics, 121st, Rhode-Saint-Genèse, Belgium, Mar 15-19, 1982, Hampton, VA, Mar 10, 11, 1982, Gottingen, West Germany, Mar 22-25, 1982)* ONERA, TP no 1982-5, 1982. 28 p. 77 refs.

Descriptions are given of the use of solid, liquid or gas tracers in water and wind tunnels for the visualization of aerodynamic flows, with emphasis on the methods employed by the experimental facilities of ONERA. The range of visualization techniques covered reveal flow patterns with all their parietal singularities, as well as the evolution of such patterns as a function of such aerodynamic parameters as incidence, yaw angle and Reynolds number. Visualization methods also reveal the separation phenomena which characterize high incidence angle aerodynamics, and they precisely define vortical, transitional and unsteady flow regimes. The aerodynamic surfaces tested by visualization methods include airfoil profiles, sweptback wings, slender bodies, inlets, and entire aircraft configurations. Attention is given the layout of ONERA and other water tunnel facilities. O C

A82-34495 # Instrumentation for testing aircraft antistatic protection. J Tillet, J L Boulay, and M Chatanier (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). *(International Aerospace Conference on Lightning and Static Electricity, Oxford University, Oxford, England, Mar 23-25, 1982)* ONERA, TP no 1982-7, 1982. 11 p. 11 refs. Research supported by the Direction des Recherches, Etudes et Techniques.

Methods and standards relating to aircraft protection against precipitation statics are discussed, and two instruments, the INJECO and CORAS, are presented. Engineering tests are performed with the instruments to facilitate the solution of problems encountered by manufacturers and airlines with precipitation statics. An advantage of INJECO is the assessment of noise produced by local discharges following charge accumulation on insulating surfaces. Synchronous detection with the CORAS device permits the measurement of relatively small voltage drops along the resistive layer in the presence of the large capacitive voltage drop across the insulating coating. When CORAS is used on DC modes, its operation is conventional and is useful in resistive coating processing to compare DC and AC surface resistance measurements. D L G

A82-34497 # Comparison of aerodynamic characteristics of aircraft models with forward and aft swept wings at Mach number 0.5. O du Boucheron and Y Brocard (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). *(University of Bristol and Royal Aeronautical Society, International Forward Swept Wing Aircraft Conference, University of Bristol, Bristol, England, Mar 24-26, 1982)* ONERA, TP no 1982-9, 1982. 12 p. 14 refs.

A schematic model with a 21-cm span was tested in the transonic S3Ch wind tunnel at M equals 0.5 to obtain aerodynamic data on various configurations with forward and aft swept wings with or without canards. Flow characteristics were described using flow visualizations in a water tunnel and in a wind tunnel. Results of calculations using a panel method show that the use of canards improves the forward swept wing flow field, even at low angles of attack. The longitudinal and lateral characteristics were compared, and various effects were investigated, including presence, location and sweep angle of canards, height of the wing relative to the fuselage and presence and sweep angle of the vertical tail. A

general weakness in the forward swept configurations was found compared to aft swept ones
D L G

A82-34498 # Automatic checking of measuring units in the Modane wind tunnels. X Bouis, G Gavet, and R Combaz (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) (*Supersonic Tunnel Association, Meeting, Seattle, WA, Mar 29, 30, 1982*) ONERA, TP no 1982-10, 1982 10 p

Hardware and software means are implemented to improve measurement accuracy, to accelerate test runs and to detect errors or failures in measuring units in Modane wind tunnels. These improvements allow the correct settings of the gains and cut-off frequencies of amplifiers and filters to be checked at regular intervals, in addition to the calibration of analog-to-digital converters. Signals are applied to the measuring unit, which, after amplification, should give voltages of -9, -6, -3, 0, 3, 6, 9, and 0 V to the converter terminals. The result is correct if the deviation does not exceed plus or minus 2 mV, except around zero, where it is required to respect the limits of plus or minus 1 mV. The overall precision of the measuring unit exceeds the range of plus or minus 0.00021
D L G

A82-34499 # Aircraft potential variations in flight. J L Boulay and P Laroche (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) (*International Aerospace Conference on Lightning and Static Electricity, Oxford University, Oxford, England, Mar 23-25, 1982*) ONERA, TP no 1982-11, 1982 20 p 21 refs. Research supported by the Direction des Recherches, Etudes et Techniques

Some airborne experiments have been achieved in order to study the electrostatic behavior of an aircraft in flight. Variations of triboelectric current and potential of the aircraft were recorded in different atmospheric configurations. Some passive dischargers arrangements on the aircraft structure have been also characterized
(Author)

A82-34538 The initial lift and drag of an impulsively started airfoil of finite thickness. C-Y Chow and M-K Huang (Colorado, University, Boulder, CO) *Journal of Fluid Mechanics*, vol 118, May 1982, p 393-409 10 refs. Grant No AF-AFOSR-81-0037

An apparent masses formulation for an airfoil-shed vortex sheet combination is employed to model the initial lift and drag of an airfoil started impulsively from rest. The method is first applied to a flat plate to prove the accuracy and then extended to airfoils of finite thickness. Specific attention is given to the Joukowski airfoil, for which the flat plate is shown to be a special case. Further analysis is presented for a Karman-Trefftz airfoil. In the case of the Joukowski airfoil, increasing camber or angle-of-attack was demonstrated to increase the initial lift and drag, while increasing thickness caused a decrease. For the Karman-Trefftz airfoil, any finite trailing-edge angle was found to decrease both lift and drag to zero at the starting instant. It is concluded that thicker airfoils or airfoils with large trailing edge angles tend to resist increases in lift
M S K

A82-34607 * Outline of a multiple-access communication network based on adaptive arrays. S Zohar (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) *IEEE Transactions on Communications*, vol COM-30, May 1982, pt 2, p 1242-1248 7 refs. Contract No NAS7-100

Attention is given to a narrow-band communication system consisting of a central station trying to receive signals simultaneously from K spatially distinct mobile users sharing the same frequencies. One example of such a system is a group of aircraft and ships transmitting messages to a communication satellite. A reasonable approach to such a multiple access system may be based on equipping the central station with an n-element antenna array where n is equal to or greater than K. The array employs K sets of n weights to segregate the signals received from the K users. The weights are determined by direct computation based on position information transmitted by the users. A description is presented of an improved technique which makes it possible to reduce significantly the number of required computer operations in comparison to currently known techniques
G R

A82-34639 # Calculation of the lift distribution and aerodynamic derivatives of quasi-static elastic aircraft. Q Liu, C Wu, and Z Jian (Northwestern Polytechnical University, Xi'an, People's Republic of China) *Acta Aeronautica et Astronautica Sinica*, vol 3, Mar 1981, p 1-11 10 refs. In Chinese, with abstract in English

Quasi-static approximations of the aerodynamic characteristics of an elastic aircraft are undertaken by means of a numerical method, which may be used to evaluate the lift distribution and 11 main longitudinal aerodynamic derivatives of the elastic aircraft at subsonic speeds. Green's function methods are used for the aerodynamic calculations, and structural deformation is evaluated by the free structure influence coefficient method. Numerical examples are given, and dynamical problems of elastic aircraft are discussed. It is established that the derivatives employed may be directly adopted for elastic aircraft stability and control analyses
O C

A82-34644 # Experimental study on discharge and loss coefficients of combustor swirlers. C Zhang (Wuxi Aircraft Engine Research Institute, Wuxi,

People's Republic of China) and Y Wang (Shenyang Liming Machinery Co., Shenyang, People's Republic of China) *Acta Aeronautica et Astronautica Sinica*, vol 3, Mar 1981, p 50-57. In Chinese, with abstract in English

Blade-type swirlers used to control primary flame tube airflow in aircraft engine combustors incur losses which depend on blade stagger angle, pitch/chord ratio and blade passage area. A set of discharge characteristics and relations between loss coefficients and the parameters mentioned are given, along with the correlation of loss to discharge coefficients. It is found that the discharge coefficient varies from 0.6 to 0.9 for swirlers with different stagger angles. It is found that blade loss is smaller than secondary expansion loss for a given combustor swirler, and that the twisted blade swirler design is superior to the straight-bladed one from an aerodynamic viewpoint, offsetting its higher production costs
O C

A82-34645 # Aerodynamic coefficient identification of time-varying aircraft system and its application. T Wang (China Precision Machinery Corp., Beijing Research Institute, Beijing, People's Republic of China) *Acta Aeronautica et Astronautica Sinica*, vol 3, Mar 1981, p 67-76. In Chinese, with abstract in English

It is shown, on the basis of flight test measurements and analyses of trends in the coefficients of aircraft time-varying differential equations, that it is possible to transform the individual time-varying coefficient into a known function multiplied by an unknown constant. By extending the Newton-Raphson method to the time-varying coefficient differential equations, such undefined coefficients may be evaluated through iteration calculation. This scheme is evaluated in light of data taken during unsteady flight, and the reliability of aerodynamic coefficients obtained through this identification method is discussed. Good agreement is found between calculations and test data
O C

A82-34671 Doppler processing, waveform design and performance measures for some pulsed Doppler and MTD-radars. II. A Ludloff, N Fuchter, F Hagedorn, M Minker, and H Rohling (Telefunken AG, Ulm, West Germany) *Ortung und Navigation*, no 1, 1982, p 5-54 21 refs. Research supported by the Bundesministerium für Verkehr

Subclutter visibility (SCV), design principles, calculation of filter transfer function, and SNR and signal-to-interference ratio (SIR) improvements are discussed. The definition of SCV, the mean detection probability as a function of SCV, SCV as a function of an average SIR improvement, approximate calculation of SCV, and processor SNR loss budget are analyzed. The design principles discussed include dynamic range versus equipment noise, pulsed oscillator versus power amplifier, transversal filter bank versus MTI-FFT processing, advantages obtained by using frequency diversity, necessity of circular polarization, and radar site selection. Filter bank with MTI and DFT, filter weights derived from a modified MLR test, weighting sequences for windows, and calculation of SNR and SIR improvements are analyzed. A practical example is given
C D

A82-34672 Short-term behavior of a Doppler navigation system and comparison with position indication by means of scanning radar (Kurzzeitverhalten eines Doppler-Navigationssystems und Vergleich mit Positionsbestimmungen durch ein Vermessungsradar). K Ramsayer and G Klaedtke (Stuttgart, Universität, Stuttgart, West Germany) *Ortung und Navigation*, no 1, 1982, p 125-138. In German

A concept of integrated navigation via adjustment by the method of least squares was tested in a military aircraft. The navigation equipment of the aircraft included the Bendix DRA-12B double radar and the Sperry gyroscopic platform SYP 820 furnished with a computer integrated with TACAN and DME. The flight test results are reported. In order to test various off-line evaluation methods in addition to on-line evaluation during flight, the Doppler pulses, drift, heading, and other interesting parameters were registered. The results showed that the Doppler navigation system measurements were very 'noisy'. To determine the short-term behavior of the system, recordings were investigated for an approximately rectilinear flight of 300 seconds length. The aircraft distance, azimuth, and angle of elevation were continuously recorded by scanning radar, enabling a comparison to be made with the Doppler system
C D

A82-34700 Air cooling of gas turbine blades. O N Favorskii and S Z Kopelev (*Teploenergetika*, vol 28, Aug 1981, p 7-11) *Thermal Engineering*, vol 28, Aug 1981, p 435-438 13 refs. Translation

During the last 20 years, the gas temperature at the inlet of aircraft gas turbines has been raised by 450 K to a temperature of 1650 K. The achievement of the current high operational temperatures, which have led to a considerable enhancement in engine efficiency, has been largely made possible by the development of suitable approaches for cooling the gas turbine blades. The various factors involved in designing an effective cooling procedure are considered, taking into account the necessity that the involved flow processes must not result in a lowering of engine efficiency, and, in connection with large temperature gradients or the introduction of stress-raising design features, must not unduly reduce the operational life of the engine. Attention is given to the internal convective and the convection-film air cooling of blades, the promotion of flow turbulence by means of internal baffles, the hydraulic resistance of internal cooling channels, and merits and drawbacks of perforations
G R

A82-34737 **An optical data link for airborne scanning system.** M J Green (Wisconsin, University, Madison, WI) In American Society of Photogrammetry, Annual Meeting, 47th, Washington, DC, February 22-27, 1981, ASP Technical Papers (A82-34701 16-43) Falls Church, VA, American Society of Photogrammetry, 1981, p 476-482

In connection with a study of oceanic thermal fronts, the Navy is interested in a thermal scanning system which could be used with their P-3 patrol aircraft. A suitable scanning system would be the RS-18A scanning thermal IR radiometer. However, an obstacle regarding the envisaged use of the instrument is related to the necessity to employ the aircraft without an introduction of any modifications. The obstacle has been overcome by making use of an optical data link which replaces the hardwire connections between the scanner and the power supply. The optical link is housed in a ten inch diameter tube which is clamped in position directly behind the scanner head. G R

A82-34748 # Mach reflection of a shock wave from an inclined wall. T Ikui, K Matsuo, N Kondoh (Kyushu University, Fukuoka, Japan), and T Aoki Kyushu University, Faculty of Engineering, Memoirs, vol 41, Dec 1981, p 361-380 24 refs

The Mach reflection phenomena of shock waves that encounter a wall inclined to the shock are investigated over a wide range of incident Mach number and wedge angle using air, carbon-dioxide and chlorofluoro-carbon (Freon-12) as a working gas. A new type of reflection which cannot be classified as regular reflection, single-Mach, complex-Mach or double-Mach reflections is observed in Freon-12 and is called pseudo-regular reflection. An equation expressing the distance between a slip stream and a Mach shock wave along the wedge surface is proposed, and the phenomenon of the rolling-up of the slip stream is explained. An equation predicting the location of the kink point in the case of double-Mach reflection is presented, which agrees with experimental evidence better than Law's (1970) method. Transitions from single-Mach to complex-Mach reflections and complex-Mach to double-Mach reflections are explained, and a criterion of the rolling-up of the slip stream is presented. D L G

A82-34772 Measuring LF and MF antenna radiation patterns by means of a helicopter. D J Bem (Wroclaw, Politechnika, Wroclaw, Poland) and E Zernicki (Institute of Telecommunications, Wroclaw, Poland) In Electromagnetic compatibility 1980, Proceedings of the Fifth International Wroclaw Symposium and Exhibition, Wroclaw, Poland, September 17-19, 1980 Part 2 Wroclaw, Wydawnictwo Politechniki Wroclawskiej, 1980, p 761-769

The paper deals with a method of measuring power gain and radiation pattern of LF and MF antennae, applying the standard field produced by a loop antenna installed on a helicopter. A method of radionavigation necessary for this purpose has been presented. Results of measurements of several antennae have also been given. (Author)

A82-34814 † A study of the vibration loading of the turbine blades of an aircraft gas-turbine engine with dry-friction dampers (Issledovanie vibratsionnoi nagruzhennosti rabochikh lopatok turbiny aviatsonnogo GTD s demperami sukhogo treniya). V M Kapralov and R V Skvortsov *Problemy Prochnosti*, May 1982, p 83-85 In Russian

The use of box-type dry-friction dampers in aircraft gas-turbine engines is discussed, and a method is proposed for the determination of the required damper mass. In accordance with the proposed method, the damper mass is first determined by using an approximate formula. Further studies involving amplitude and spectral analysis make it possible to evaluate the damper efficiency and finally select the damper mass. V L

A82-34851 # Contact problems involving the flow past an inflated aerofoil. J-M Vanden-Broeck (Stanford University, Stanford, CA) *ASME, Transactions, Journal of Applied Mechanics*, vol 49, June 1982, p 263-265 10 refs USAF-Navy-Army-NSF-supported research

Steady potential flow around a two-dimensional inflated airfoil is considered. The aerofoil consists of a flexible and inextensible membrane which is anchored at both leading and trailing edges. The flow and the aerofoil shape are determined as functions of the angle of attack, the cavitation number, and the Weber number. When the cavitation number decreases to a critical value, opposite sides of the membrane become tangent to each other at the trailing edge. For values less than critical, the aerofoil is partially collapsed near the trailing edge. The length of the region of collapse increases as the cavitation number decreases and for a cavitation number equal to minus infinity, the aerofoil is completely collapsed. The shape of the aerofoil and the value of the critical cavitation number are determined analytically by a perturbation solution for small Weber numbers. Graphs of the results are presented. (Author)

A82-34861 # Unconventional internal cracks. II - Method of generating simple cracks. C H Wu (Illinois, University, Chicago, IL) *ASME, Transactions, Journal of Applied Mechanics*, vol 49, June 1982, p 383-388 10 refs

The meaning of the word crack is extended to include holes with cusps of vanishing cusp angle. A crack is said to be simple if the associated elasticity

problem has a closed-form solution. Many classes of simple cracks are constructed and solved in this two-part paper. In particular, a method of constructing very sharp cusps is described. These cusps possess not only a zero slope (zero cusp angle) but a vanishing curvature as well. In fact, a crack may be constructed in such a way that the first N derivatives are all zero. (Author)

A82-34879 A review and assessment of fatigue crack growth rate relationships for metallic airframe materials. J B Chang, M Szamosi, and E Klein (Rockwell International Corp, North American Aircraft Div, Los Angeles, CA) In Fracture and failure. Analyses, mechanisms and applications, Proceedings of the Symposium, Los Angeles, CA, March 17-20, 1980 Metals Park, OH, American Society for Metals, 1981, p 35-54 13 refs Contract No. F33615-77-C-3121

An R&D program recently undertaken by Rockwell for the U.S. Air Force is aimed at upgrading the fatigue crack growth prediction technology required for implementation of the damage tolerance control procedures throughout the life cycle of any weapon system. To accomplish this objective, it was considered necessary to review and evaluate the state-of-the-art fatigue crack growth rate equations commonly used for performing damage-tolerance analysis on airframe structures. Three such rate equations (the Boeing, Grumman, and Rockwell equations) were assessed using baseline crack growth test data. It is shown that, by properly choosing the rate constants, all three equations can be used to characterize the fatigue crack growth rate relationships for airframe materials. B J

A82-34882 Failure analysis of silica phenolic nozzle liners. M Katcher (Marquardt Co, Van Nuys, CA) In Fracture and failure. Analyses, mechanisms and applications, Proceedings of the Symposium, Los Angeles, CA, March 17-20, 1980 Metals Park, OH, American Society for Metals, 1981, p 165-183

The Marquardt Company's failure investigation of cracking in two silica phenolic nozzle liners during proof testing is described. The proof testing consisted of pressuring the nozzles to 14.1 MPa for 5 to 20 sec. It is found that the longitudinal cracking of the convergent exhaust nozzle insulators was due to the use of bad fiber/fabric material by a supplier. This material was used in the manufacture of silica phenolic tape that was later used by Marquardt's exhaust nozzle liner supplier. The bad fiber/fabric could not be distinguished by then current quality control procedures which assessed tape strength properties in the warp as opposed to the bias direction. It was also found that the introduction of the bad fiber/fabric material was the only distinctive difference between the nozzle insulators that failed and other nozzles that had successfully passed. B J

A82-34953 # Large scale aeroengine compressor test facility. *Ishikawajima-Harima Engineering Review*, vol 22, Mar 1982, p 133-136 In Japanese, with abstract in English

Installation of a test facility for large compressors has recently been completed at IHI Mizuho Plant to serve in the development of aircraft engine components. The facility comprises a driving unit (IHI-developed IM 2000 gas turbine), intake and exhaust systems for the test compressor, and a data acquisition system. It is capable of testing compressors up to 18,000 SPS (13.2 MW) with maximum speed of 13,000 rpm. The whole system has been compactly designed to be installed in a small space as compared with similar facilities constructed in the past. The data acquisition system makes full use of the latest developments in minicomputers and pressure/temperature measuring devices to provide on-line computing of the measured data for instant display of the compressor overall performance as well as detailed aerodynamic properties of the internal flow field. The system has already been utilized for the front fan model testing of the RJ 500 engine which is an Anglo-Japanese collaborative engine for the next generation civil transport and proven to be a very effective tool for the achievement of high level performance requirements. (Author)

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STAR ENTRIES

N82-24163# Naval Postgraduate School, Monterey, Calif
CANNIBALIZATION OF THE F-14 AND S-3A AIRCRAFT. A VIABLE LOGISTIC M.S. ThesisKevin M Myette Mar 1981 112 p refs
(AD-A111207) Avail NTIS HC A06/MF A01 CSCL 05/1

This thesis presents the results of an analysis of cannibalization and its effects on the F-14A and S-3A aircraft. The analysis includes cannibalization measurement methodologies, reasons why squadrons cannibalize, a comparison of fleet cannibalization activity and alternatives to cannibalization. Cannibalization is shown not to be a maintenance practice to be avoided at all cost, but rather a viable cost effective alternative to logistic failures. Additionally, material issue response delays rather than material shortages were found to lead to increased cannibalization.

Author (GRA)

N82-24164# Societe Nationale Industrielle Aerospatiale, Toulouse (France) Direction Etudes
THE AIRBUS FAMILY OF AIRCRAFT AT THE DAWN OF THE 1980'S [LA FAMILLE 'AIRBUS' A L'AUBE DES ANNEES 1980]G Broihanns 7 Jan 1982 9 p in FRENCH Submitted for publication
(SNIAS-821-111-101) Avail NTIS HC A02/MF A01

The development and marketing of the European Airbus are reviewed. General characteristics of the A-300 B7, already in service, are presented, including flight performance and operational costs. Industrial spin-offs from the project and the impetus to European competitiveness in the field of civil aviation are mentioned. Among ongoing developments and future projects the A-310 aircraft and A-300-600 aircraft are cited.

Author (ESA)

N82-24165# National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio**EXPERIMENTAL AND ANALYTICAL RESULTS OF TANGENTIAL BLOWING APPLIED TO A SUBSONIC V/STOL INLET**
Richard R Burley and Danny P Hwang 1982 18 p refs
Proposed for presentation at the 18th Joint Propulsion Conf., Cleveland, 21-23 Jun 1982 sponsored by AIAA, SAE and ASME

(NASA-TM-82847, E-1217, NAS 1 15 82847) Avail NTIS HC A02/MF A01 CSCL 01A

Engine inlets for subsonic V/STOL aircraft must operate over a wide range of conditions without internal flow separation. Experimental and analytical investigations were conducted to evaluate the effectiveness of tangential blowing to maintain attached flow to high angles of attack. The inlet had a relatively thin lip with a blowing slot located either on the lip or in the diffuser. The height and width of these slots was varied. Experimentally determined flow separation boundaries showed that lip blowing achieved higher angle of attack capability than diffuser blowing. This capability was achieved with the largest slot circumferential extent and either of the two slot heights. Predicted (analytical) separation boundaries showed good agreement except at the highest angles of attack.

S L

N82-24166# Ohio State Univ., Columbus Dept of Aeronautical and Astronautical Engineering**RIME ICE ACCRETION AND ITS EFFECT ON AIRFOIL PERFORMANCE Ph.D. Thesis. Final Report**Michael B Bragg Mar 1982 182 p refs
(Grant NAG3-28)

(NASA-CR-165599, NAS 1 26 165599) Avail NTIS HC A09/MF A01 CSCL 01A

A methodology was developed to predict the growth of rime ice, and the resulting aerodynamic penalty on unprotected, subcritical, airfoil surfaces. The system of equations governing

the trajectory of a water droplet in the airfoil flowfield is developed and a numerical solution is obtained to predict the mass flux of super cooled water droplets freezing on impact. A rime ice shape is predicted. The effect of time on the ice growth is modeled by a time-stepping procedure where the flowfield and droplet mass flux are updated periodically through the ice accretion process. Two similarity parameters, the trajectory similarity parameter and accumulation parameter, are found to govern the accretion of rime ice. In addition, an analytical solution is presented for Langmuir's classical modified inertia parameter. The aerodynamic evaluation of the effect of the ice accretion on airfoil performance is determined using an existing airfoil analysis code with empirical corrections. The change in maximum lift coefficient is found from an analysis of the new iced airfoil shape. The drag correction needed due to the severe surface roughness is formulated from existing iced airfoil and rough airfoil data. A small scale wind tunnel test was conducted to determine the change in airfoil performance due to a simulated rime ice shape.

Author

N82-24167# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif**THREE-DIMENSIONAL SEPARATION AND REATTACHMENT**David J Peake and Murray Tobak Mar 1982 17 p refs
(NASA-TM-84221, A-8845, NAS 1 15 84221) Avail NTIS HC A02/MF A01 CSCL 01A

The separation of three dimensional turbulent boundary layers from the lee of flight vehicles at high angles of attack is investigated. The separation results in dominant, large scale, coiled vortex motions that pass along the body in the general direction of the free stream. In all cases of three dimensional flow separation and reattachment, the assumption of continuous vector fields of skin friction lines and external flow streamlines, coupled with simple laws of topology, provides a flow grammar whose elemental constituents are the singular points: the nodes, spiral nodes (foci), and saddles. The phenomenon of three dimensional separation may be construed as either a local or a global event, depending on whether the skin friction line that becomes a line of separation originates at a node or a saddle point.

B W

N82-24168# Bihrie Applied Research, Inc., Jericho, N Y
F-15 ROTARY BALANCE DATA FOR AN ANGLE-OF-ATTACK RANGE OF 8 DEG TO 90 DEG Final ReportBilly Barnhart Washington NASA May 1982 376 p refs
2 Vol

(Contract NAS1-16205)

(NASA-CR-3478, NAS 1 26 3478) Avail NTIS HC A17/MF A01 CSCL 01A

Aerodynamic characteristics obtained in a rotational flow environment, utilizing a rotary balance are presented in plotted form for a 1/12 scale F-15 airplane model. The configurations tested included the buildup of airplane components and the basic airplane with various control deflections. Data are presented for all configurations without analysis for an angle of attack range of 8 to 90 deg, and clockwise and counterclockwise rotations covering an omega b/2V range from 0 to 0.4. Selected configurations are presented over an extended omega b/2V range from 0 to 0.9.

S L

N82-24169# Bihrie Applied Research, Inc., Jericho, N Y
ROTARY BALANCE DATA FOR AN F-15 MODEL WITH CONFORMAL FUEL TANKS FOR AN ANGLE-OF-ATTACK RANGE OF 8 DEG TO 90 DEG Final ReportBilly Barnhart Washington NASA May 1982 377 p refs
2 Vol

(Contract NAS1-16205)

(NASA-CR-3516, NAS 1 26 3516) Avail NTIS HC A17/MF A01 CSCL 01A

Aerodynamic characteristics obtained in a rotational flow environment, utilizing a rotary balance, are presented in plotted form for a 1/12 scale conformal fuel tank equipped F-15 airplane model. The configurations tested included in the buildup of airplane components and the basic airplane with various control deflections. Data are presented for all configurations without analysis for an angle of attack range of 8 to 90 deg, and clockwise and counterclockwise rotations covering an omega b/2V range from 0 to 0.4. Selected configurations are presented over an extended omega b/2V range from 0 to 0.9.

S L

N82-24176

N82-24176*# National Aeronautics and Space Administration, Washington, D C

CURRENT DEVELOPMENTS LIGHTER THAN AIR SYSTEMS

Norman J Mayer 1981 15 p refs Presented at the United Nations Ind Develop Organ Conf, Vienna, 19-22 Oct 1981 (NASA-TM-84744, NAS 1 15 84744) Avail NTIS HC A02/MF A01 CSCL 01A

Lighter than air aircraft (LTA) developments and research in the United States and other countries are reviewed. The emphasis in the U.S. is on VTOL airships capable of heavy lift, and on long endurance types for coastal maritime patrol. Design concepts include hybrids which combine heavier than air and LTA components and characteristics. Research programs are concentrated on aerodynamics, flight dynamics, and control of hybrid types. Author

N82-24181# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering

EFFECT OF MODIFICATION OF THE TRAILING EDGE OF A SEPARATING WALL ON THE DOWNSTREAM MIXING OF PARALLEL FLOWING STREAMS M.S. Thesis

Daniel J Gurecki Dec 1981 76 p refs (AD-A111124, AFIT/GAE/AA/81D-12) Avail NTIS HC A05/MF A01 CSCL 20/4

The objective of this thesis is to study ways to enhance the mixing of two parallel streams of air by modifying the trailing edge of a separating wall. An apparatus was designed which achieved two-dimensional, good quality flow near the center of the test section passage, with freestream turbulence intensity of 2.2 percent. Measurements of the wake were made varying the velocity of one stream down to 37.5 percent of the other stream velocity, both in and upstream of the asymptotic region of the wake. A single element hot wire was used to measure velocity and RMS readings. The flat plate trailing edge was then slotted with five, eight millimeter slots and re-tested. The higher turbulence and wider wake of the flat plate indicate that the slotted plate wake does not achieve as good mixing as the flat plate wake. No velocity ratio of the two streams was found to maximize the wake growth for either configuration. Wake growth doubled when the slower velocity was 0.40 of the faster velocity. Author (GRA)

N82-24182# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering

AN EXPERIMENTAL INVESTIGATION OF THE FLOW FIELD OF AN EJECTOR WING DESIGN EMPLOYING A PHOTON CORRELATION LASER VELOCIMETER M.S. Thesis

Damon G Stephens Dec 1981 122 p refs (AD-A111134, AFIT/GAE/AA/81D-30) Avail NTIS HC A06/MF A01 CSCL 20/2

The flow field about a dual element airfoil model employing an ejector for aerodynamic blowing is investigated. Flow visualization is obtained by smoke tunnel testing. Mean velocities and turbulence intensities are determined at various flow field locations. All data is obtained through the use of a Laser Doppler Velocimeter (LDV) using a photon correlation processing scheme. Flow field properties are computed from the LDV generated autocorrelation function. The free stream velocity and Reynolds number based on model chord length are 8 m/sec and 325,000 respectively. Two ejector velocity ratios are investigated ($U_{\text{ejector}}/U_{\text{free stream}} = 0$ and 2). Flow visualization photography is conducted at seven angles of attack: -5 deg, 0 deg, 5 deg, 10 deg, 15 deg, 20 deg, and 25 deg and LDV data is acquired at 0 deg and 15 deg angles of attack. The results are presented in the form of flow visualization photographs and profiles of mean velocities and turbulence intensities. Conclusions are drawn concerning the aerodynamic benefit of the ejector wing design for possible V/STOL applications. GRA

N82-24183# Societe Nationale Industrielle Aerospatiale, Toulouse (France) Direction Etudes

ACCOUNTING FOR THICKNESS EFFECTS IN THE CALCULATION OF SUBCRITICAL UNSTEADY AERODYNAMIC FORCES: APPLICATION TO WING-FUSELAGE INTERACTIONS [PRISE EN COMPTE DES EFFETS D'EPaisseur DANS LE CALCUL DES FORCES AERODYNAMIQUES INSTATIONNAIRES SURCRITIQUES. APPLICATIONS AUX INTERACTIONS FUSELAGE/SURFACES PORTANTES]

R Barreau, M Verdier, and J P Robert 7 Jan 1982 47 p refs In FRENCH Presented at AAFA Colloq, Poitiers, France,

18-20 Nov 1981

(SNIAS-821-111-106) Avail NTIS HC A03/MF A01

A calculation method that yields an aerodynamic influence coefficient matrix for infinitely thin wings in a subsonic harmonic flow was modified in order to take into account the presence of a fuselage. A solution was obtained by the doublet lattice method and the method of singularities. Results relate to the development of generalized active control which requires a meticulous and precise knowledge of local unsteady aerodynamic forces. The computer program seems to give coherent results, the presence of a fuselage notably affecting the first chords of the wing. However, the method has not been sufficiently validated by calculations of aeroelastic significance. Author (ESA)

N82-24186*# Lockheed-California Co., Burbank

TRANSPORT AIRCRAFT CRASH DYNAMICS Final Report, Jan. 1980 - Mar. 1982

Gil Wittlin, Max Gamon, and Dan Shycoff Atlantic City, NJ FAA Mar 1982 471 p refs

(Contract NAS1-16083) (NASA-CR-165851, NAS 1 26 165851, FAA-CT-82-69) Avail NTIS HC A20/MF A01 CSCL 01C

Transport airplane accident data is presented. Formulation of candidate crash scenarios, the identification of the involvement of structural systems and subsystems in transport airplane accidents, a review of existing design criteria and philosophy, and conclusions and recommendations for R&D are included. The accident is organized in relation to pertinent accident types including undershoot, overrun, ground collision, obstacle impact, stall, wheels up or retracted landing, swerve and gear collapse. Ground to ground and air to ground crash scenarios are presented. Current state of the art procedures are used in the analysis of a current airplane configuration for selected accident conditions. Available structure and occupant modeling techniques are assessed with regard to transport airplane crash dynamics modeling requirements. Design criteria and full scale crash tests are evaluated with regard to transport airplane applicability. A integrated crash dynamics analysis and test program for transport airplanes is presented along with conclusions and recommendations based on the results of the overall study. An accident data base computer program is described. S L

N82-24188# Auburn Univ., Ala Dept of Electrical Engineering

MARINE AIR TRAFFIC CONTROL AND LANDING SYSTEM (MATCALS INVESTIGATION), VOLUME 1

E R Graf, C L Phillips, and S A Starks Sep 1981 396 p refs Prepared for Georgia Inst of Technology, Atlanta 2 Vol (Contracts N00039-80-C-0032, N66314-73-C-0565, N66314-74-C-1362, N66314-74-C-1634, N00228-75-C-2080, N00228-76-C-2069, N00228-78-C-2233)

(AD-A110862, GIT/EES-1-A-2550-Vol-1) Avail NTIS HC A17/MF A01 CSCL 17/7

This report contains the results of the continuation of Marine Air Traffic Control and Landing System (MATCALS) investigations. The report is organized into three main sections, namely Part Two, Part Three, and Part Four. Part Two presents a method of estimating the centroid location of a target utilizing a scan return amplitude versus angle information. Part Three contains the results of an investigation into replacing the alpha-beta filter in the MATCAL digital controller with an observer, in order to reduce the effects of radar noise. Part Four presents the results of an investigation into replacing the same alpha-beta filter with a tri-state adaptive filter, in order to reduce the effects of radar noise. GRA

N82-24189# Auburn Univ., Ala Dept of Electrical Engineering

MARINE AIR TRAFFIC CONTROL AND LANDING SYSTEM (MATCALS INVESTIGATION), VOLUME 2

E R Graf, C L Phillips, and S A Starks Sep 1981 155 p refs Prepared for Georgia Inst of Technology, Atlanta 2 Vol (AD-A110863, GIT/EES-1-A-2550-Vol-2) Avail NTIS HC A08/MF A01 CSCL 17/7

Three observers, designed for a reduced order system that represents the lateral system of F4J aircraft in an automatic landing configuration, are discussed. The observers are to be used in the aircraft's lateral control system to estimate its lateral position and lateral velocity. Results obtained from simulation

studies indicate that an observer may be used to improve the system's response M D K

N82-24192# Fondazione Ugo Bordoni, Rome (Italy)

ROUND TABLE DISCUSSION ON THE TRANSFER OF RESULTS FROM THE PROJECT 'AIDS TO NAVIGATION AND CONTROL OF AIR TRAFFIC' Final Report [TAVOLA ROTONDA SUL TRASFERIMENTO DEI RISULTATI DEL PROGETTO FINALIZZATO 'AIUTI ALLA NAVIGAZIONE E CONTROLLO DEL TRAFFICO AEREO']

Francesco Valdoni 1981 20 p In ITALIAN Presented at Rome, 27 Mar 1981, sponsored by CNR (FUB-20-ATC-1981) Avail NTIS HC A02/MF A01

The transfer of results from a project was discussed. Their contributions are summarized. The main subjects include assistance to national planning of navigation aids and traffic control, consultancy to state agencies, propositions to present to the International Civil Aviation Organization, marketing of Italian products derived from project research, and research planning after the project. Author (ESA)

N82-24193# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

TIRE TREAD TEMPERATURES DURING ANTISKID BRAKING AND CORNERING ON A DRY RUNWAY

John A. Tanner, Robert C. Dreher, Sandy M. Stubbs, and Eunice G. Smith May 1982 57 p refs (NASA-TP-2009, L-15110, NAS 160 2009) Avail NTIS HC 04/MF A01 CSCL 01C

Aircraft tire tread temperatures under transient conditions associated with antiskid braking and cornering operations were studied. Peak tread temperatures were shown to be much lower when the braking effort did not reach the incipient skid point than when the tire was forced into incipient skids. Braking operation at high yaw angles increased average tread temperatures. Tire energy dissipation associated with braking and cornering was far greater than that associated with wheel spin-up at touchdown. The maximum friction level developed by a worn tire is shown to be more sensitive to variations in tread temperature and ground speed than that developed by a new tire. Locked-wheel skids and braking and cornering operations at high yaw angle produced molten rubber deposits on the runway surface and tread temperatures high enough to cause the rubber to undergo changes in chemical composition. R J F

N82-24194# Textron Bell Helicopter, Fort Worth, Tex

V/STOL TILT ROTOR RESEARCH AIRCRAFT. VOLUME 1. GENERAL INFORMATION, REVISION C

Mike Kimbell and Aaron Whitener 8 Aug 1980 357 p refs 4 Vol (Contract NAS2-7800)

(NASA-CR-166347, NAS 126 166347, REPT-301-099-022C) Avail NTIS HC A16/MF A01 CSCL 01C

The configuration, operation and maintenance requirements for the contractor-furnished portion of the XV-15 research instrumentation and data acquisition system are defined. Descriptions of systems operation, maintenance and checkout procedures, and cable designations are given. R J F

N82-24195# Textron Bell Helicopter, Fort Worth, Tex

V/STOL TILT ROTOR RESEARCH AIRCRAFT. VOLUME 2: SHIP 1 INSTRUMENTATION

11 Aug 1978 456 p refs Sponsored by NASA 4 Vol (NASA-CR-166348, NAS 126 166348) Avail NTIS HC A20/MF A01 CSCL 01C

Information covering sensor cables, sensor installation and sensor calibration for the XV-15 aircraft number 1 is included. For each junction box (J-box) designation there is a schematic of the J-box disconnect harness instrumentation worksheets which show sensor location, and calibration data sheets for each sensor associated with that J-box. An index of measurement item codes to J-box locations is given in a table. Cross references are given. R J F

N82-24196# Textron Bell Helicopter, Fort Worth, Tex

V/STOL TILT ROTOR RESEARCH AIRCRAFT. VOLUME 3: SHIP 2 INSTRUMENTATION

11 Aug 1978 579 p refs Sponsored by NASA 4 Vol (NASA-CR-166349, NAS 126 166349) Avail NTIS HC A25/MF A01 CSCL 01C

Information covering sensor cables, sensor installation, and

sensor calibration for the XV-15 aircraft number 2 is included. For each junction box (J-box) designation there is a schematic of the J-box disconnect harness, instrumentation worksheets which show sensor location, and calibration data sheets for each sensor associated with that J-box. An index of measurement data codes to J-box locations is given in a table. Cross references are given. R J F

N82-24197# Textron Bell Helicopter, Fort Worth, Tex

V/STOL TILT ROTOR RESEARCH AIRCRAFT. VOLUME 4: CFE TECHNICAL DATA

1 Oct 1980 319 p refs Sponsored by NASA (NASA-CR-166350, NAS 126 166350) Avail NTIS HC A14/MF A01 CSCL 01C

Manufacturer drawings and specifications for contractor furnished transducers and related equipment for the XV-15 aircraft research instrumentation and data acquisition system are given. R J F

N82-24198# Texas A&M Univ., College Station Dept of Mechanical Engineering

DEVELOPMENT OF EXPERIMENTALLY COMPATIBLE SUBSYSTEM METHODS FOR THE ANALYSIS OF AIRCRAFT STRUCTURES. Final Report, 1 Apr. - 30 Sep 1981

Sherif T. Noah Nov 1981 50 p refs (Grant AF-AFOSR-0141-81) (AD-A111242, AFOSR-82-0050TR) Avail NTIS HC A03/MF A01 CSCL 01/3

This study is directed toward the development of experimentally compatible synthesis techniques for the determination of the dynamic characteristics of structures from the characteristics of their components. Based on an assessment of existing methods, selected free-interface component mode methods are utilized for the development. A simple technique is developed by which the residual effects, of truncated substructures' modes, required in forming the synthesis can be directly determined from test data. The data is to be obtained by shaking each of the substructures at a single point. Depending on the type of substructures involved, the inclusion of these residual effects is shown to be very significant in drastically improving the predicted modal shapes and damping of their assembly. A method is also presented for extending the selected synthesis formulations to enable their application to non-proportionally damped substructures. The study summarized in this report clearly demonstrates the feasibility of developing general, experimentally compatible synthesis techniques. Recommendations are included for the generalization and further development of the techniques developed in this study. Author (GRA)

N82-24199# Kaman Aerospace Corp., Windsor, Conn

EXPERIMENTAL VERIFICATION OF FORCE DETERMINATION AND GROUND FLYING ON A FULL-SCALE HELICOPTER. Final Report, May 1977 - Dec. 1980

R. Jones, W. G. Fannelly, E. J. Nagy, and J. A. Fabunmi May 1981 164 p refs (Contract DAAJ02-77-C-0027, DA Proj 1L2-62209-AH-76) (USAAVRADCOM-TR-81-D-11, R-1625) Avail NTIS HC A08/MF A01

Force determination is a method of obtaining dynamic loads acting on a vehicle in flight. These loads were determined from measured fuselage responses obtained in flight and calibration matrices obtained in a shake test. These forces obtained were verified by ground flying in a hangar and duplicated the responses obtained in flight. Author

N82-24201# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

A PIECEWISE LINEAR STATE VARIABLE TECHNIQUE FOR REAL TIME PROPULSION SYSTEM SIMULATION

James R. Mihalow and Stephen P. Roth (Pratt and Whitney Aircraft Group, West Palm Beach, Fla.) 1982 16 p refs Presented at the 13th Ann Pittsburgh Conf on Modeling and Simulation, Pittsburgh, 22-23 Apr 1982 sponsored by IEEE, ISA, SCS and SMCS

(NASA-TM-82851, E-1210, NAS 115 82851) Avail NTIS HC A02/MF A01 CSCL 21E

The emphasis on increased aircraft and propulsion control system integration and piloted simulation has created a need for higher fidelity real time dynamic propulsion models. A real time propulsion system modeling technique which satisfies this need and which provides the capabilities needed to evaluate propulsion system performance and aircraft system interaction

on manned flight simulators was developed and demonstrated using flight simulator facilities at NASA Ames. A piecewise linear state variable technique is used. This technique provides the system accuracy, stability and transient response required for integrated aircraft and propulsion control system studies. The real time dynamic model includes the detail and flexibility required for the evaluation of critical control parameters and propulsion component limits over a limited flight envelope. The model contains approximately 70 K bytes of in-line computational code and 147 K of block data. It has an 89 ms cycle time on a Xerox Sigma 9 computer. A Pegasus-Harrier propulsion system was used as a baseline for developing the mathematical modeling and simulation technique. A hydromechanical and water injection control system was also simulated. The model was programmed for interfacing with a Harrier aircraft simulation at NASA Ames. Descriptions of the real time methodology and model capabilities are presented. Author

N82-24202*# Garrett Turbine Engine Co., Phoenix, Ariz
STUDY OF ADVANCED PROPULSION SYSTEMS FOR SMALL TRANSPORT AIRCRAFT TECHNOLOGY (STAT) PROGRAM Final Report

C F Baerst, R W Heldenbrand, and J H Rowse Mar 1981 119 p refs
(Contract NAS3-21997)

(NASA-CR-165610 NAS 1 26 165610, Garrett-21-3911) Avail NTIS HC A06/MF A01 CSCL 21E

Definitions of takeoff gross weight, performance, and direct operating cost for both a 30 and 50 passenger airplane were established. The results indicate that a potential direct operating cost benefit resulting from advanced technologies, of approximately 20 percent would be achieved for the 1990 engines. Of the numerous design features that were evaluated, only maintenance-related items contributed to a significant decrease in direct operating cost. Recommendations are made to continue research and technology programs for advanced component and engine development. T M

N82-24203*# National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio
FUTURE PROPULSION OPPORTUNITIES FOR COMMUTER AIRPLANES

William C Strack Washington 1982 24 p refs Presented at the Commuter Airlines Meeting, Savannah, 24-26 May 1982, sponsored by the Society of Automotive Engineers
(NASA-TM-82880, E-1256, NAS 1 15 82880) Avail NTIS HC A02/MF A01 CSCL 21E

Commuter airplane propulsion opportunities are summarized. Consideration is given to advanced technology conventional turboprop engines, advanced propellers, and several unconventional alternatives: regenerative turboprops, rotaries, and diesels. Advanced versions of conventional turboprops (including propellers) offer 15-20 percent savings in fuel and 10-15 percent in DOC compared to the new crop of 1500-2000 SHP engines currently in development. Unconventional engines could boost the fuel savings to 30-40 percent. The conclusion is that several important opportunities exist and, therefore, powerplant technology need not plateau. Author

N82-24204# Solar Turbines International, San Diego, Calif
EVALUATION OF CAST TITANIUM ALLOY COMPRESSOR COMPONENTS, VOLUME 1 Final Report, May 1978 - Aug. 1978

Alvin N Hammer St Louis, Mo Army Aviation Research and Development Command Nov 1981 84 p 2 Vol
(Contract DAAG46-76-C-0042)
(AD-A114431, RDR-1827-18-Vol-1, USAVRADCOM-TR-80-F-10-VOL-1, AMMRC-TR-81-56-VOL-1) Avail NTIS HC A05/MF A01 CSCL 21/5

The objective of this program was to characterize the properties of cast titanium alloy compressor impellers to provide a background for design, processing, and qualification for service in the Solar T62T-40 Titan auxiliary power unit and similar small radial gas turbine engines. Four titanium alloy investment casting foundries participated in the production of straight vane test wheels, a low-cost representation of the compressor impellers. As-cast and hot isostatic pressed (HIPed) Ti-6Al-4V was seen to have less than half the high cycle fatigue strength (20 to 30 ksi versus 60 ksi) of equivalent sections from forged and machined impellers. A modified solution heat treatment and aging cycle was developed which restored the fatigue strength to

approximately 50 ksi, and which provided adequate tensile strength and ductility. High cycle fatigue strength of weld repaired vanes was significantly lower than that of unwelded, however. Cast and machined wheels offer substantial cost savings over wheels conventionally machined from forgings. These savings may be as much as 50%, or about \$900 per wheel.

Author (GRA)

N82-24205* National Aeronautics and Space Administration
Langley Research Center, Hampton, Va

HYDRAULIC ACTUATOR MECHANISM TO CONTROL AIRCRAFT SPOILER MOVEMENTS THROUGH DUAL INPUT COMMANDS Patent

Stephen C Irick, inventor (to NASA) Issued 9 Jun 1981 5 p
Filed 17 Aug 1979 Supersedes N80-11065 (18 - 02, p 0148)

(NASA-Case-LAR-12412-1, US-Patent-4,272,046, US-Patent-Appl-SN-067595, US-Patent-Class-244-226, US-Patent-Class-244-78, US-Patent-Class-244,213 US-Patent-Class-74-480R US-Patent-Class-74-479) Avail US Patent and Trademark Office CSCL 01C

An aircraft flight spoiler control mechanism is described. The invention enables the conventional, primary spoiler control system to retain its operational characteristics while accommodating a secondary input controlled by a conventional computer system to supplement the settings made by the primary input. This is achieved by interposing springs between the primary input and the spoiler control unit. The springs are selected to have a stiffness intermediate to the greater force applied by the primary control linkage and the lesser resistance offered by the spoiler control unit. Thus, operation of the primary input causes the control unit to yield before the springs, yet operation of the secondary input, acting directly on the control unit, causes the springs to yield and absorb adjustments before they are transmitted into the primary control system.

Official Gazette of the U S Patent and Trademark Office

N82-24206*# Minnesota Univ., Minneapolis Inst of Technology

EIGENSPACE TECHNIQUES FOR ACTIVE FLUTTER SUPPRESSION Semiannual Progress Report, 1 Oct. 1981 31 Mar. 1982

W L Garrard 31 Mar 1982 116 p refs
(Grant NAG1-217)

(NASA-CR-168931, NAS 1 26 168931) Avail NTIS HC A06/MF A0 CSCL 01C

Mathematical models to be used in the control system design were developed. A computer program, which takes aerodynamic and structural data for the ARW-2 aircraft and converts these data into state space models suitable for use in modern control synthesis procedures, was developed. Reduced order models of inboard and outboard control surface actuator dynamics and a second order vertical wind gust model were developed. An analysis of the rigid body motion of the ARW-2 was conducted. The deletion of the aerodynamic lag states in the rigid body modes resulted in more accurate values for the eigenvalues associated with the plunge and pitch modes than were obtainable if the lag states were retained. Author

N82-24208*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif

PREDICTION OF AIRCRAFT HANDLING QUALITIES USING ANALYTICAL MODELS OF THE HUMAN PILOT

Ronald A Hess Apr 1982 11 p refs
(NASA-TM-84233, A-8884, NAS 1 15 84233) Avail NTIS HC A02/MF A01 CSCL 01C

The optimal control model (OCM) of the human pilot is applied to the study of aircraft handling qualities. Attention is focused primarily on longitudinal tasks. The modeling technique differs from previous applications of the OCM in that considerable effort is expended in simplifying the pilot/vehicle analysis. After briefly reviewing the OCM a technique for modeling the pilot controlling higher order systems is introduced. Following this, a simple criterion for determining the susceptibility of an aircraft to pilot induced oscillations is formulated. Finally, a model based metric for pilot rating prediction is discussed. The resulting modeling procedure provides a relatively simple, yet unified approach to the study of a variety of handling qualities problems. R J F

N82-24209*# National Aeronautics and Space Administration
Langley Research Center, Hampton, Va

APPLICATION OF MODAL CONTROL TO WING-FLUTTER SUPPRESSION

Aaron J Ostroff and Samuel Pines (Analytical Mechanics Associates, Inc., Jericho, NY) May 1982 73 p refs (NASA-TP-1983, L-14976 NAS 160 1983) Avail NTIS HC A04/MF A01 CSCL 01C

A discrete modal control design approach that is applied to a single control surface, unswept aircraft wing subject to bending torsion flutter is described. The modal approach is a mathematical method to decouple the equations of motion into isolated differential equations. In this paper, a pole-placement approach is then applied to determine stability gains in the discrete plane using only the two complex-conjugate flutter-mode equations. A fixed gain Kalman filter is used to estimate the model amplitudes using three measurements. Results are presented for a full-state estimator (36 states) and two reduced state estimators using two different closed-loop pole locations. The control law is designed for a dynamic pressure that is 50 percent greater than the uncontrolled flutter dynamic pressure. With constant control-law gains, the closed-loop system remains stable over the dynamic-pressure range from flutter onset to approximately an 80-percent increase in pressure. M D K

N82-24210# Royal Aircraft Establishment, Farnborough (England)

THE DETERMINATION OF CRITICAL FLUTTER CONDITIONS OF NONLINEAR SYSTEMS

D L Woodcock Mar 1981 26 p refs (RAE-TM-Struct-986, BR80499) Avail NTIS HC A03/MF A01

Direct determination of limit cycles of the periodic motion of aeroelastic systems in transonic flow is discussed. A method of imposed disturbances, based on energy balance methods, is proposed. The Lagrange equation of motion is approximated by a nonlinear matrix differential equation into which a nondimensional time, ωt , is introduced. Ω is the frequency of the periodic motion. The frequency parameter based on ω , the airspeed, V and a reference length is ϵ . The relationship between the amplitude of steady state oscillations and V , and whether these oscillations are stable, are determined. Any one of the unknowns, e.g., ϵ , can be used to find the others. Author (ESA)

N82-24211# European Space Agency, Paris (France)

A METHOD FOR DETERMINING THE AEROELASTIC BEHAVIOR OF AIRCRAFT WITH ACTIVE CONTROL SYSTEMS Ph.D Thesis - Tech. Univ. Carolo-Wilhelmina, West Germany

Raymond Freymann Feb 1982 129 p refs Transl into ENGLISH from "Ueber das aeroelastische Verhalten von Flugzeugen mit aktiven Servo-Kontrollsystemen", Rept DFVLR-FB-81-05 DFVLR, Goettingen, West Germany, Feb 1981 Original report in GERMAN previously announced as N82-10047 (ESA-TT-719, DFVLR-FB-81-05) Avail NTIS HC A07/MF A01, original report in GERMAN available at DFVLR Cologne DM 26.30

An analytical method for performing dynamic calculations on servocontrolled aircraft based on an extended formulation of the generalized aeroelastic equations, is presented. The additional parameters introduced in the extended equations of motion are determined experimentally in a ground vibration test performed on a real aircraft structure as well as with help from an experimental-analytical method for determining the transfer functions of the hydraulic actuators. The elaborated method is shown to be satisfactory by comparison of measured and calculated data resulting from investigations performed on a model wing structure with a rudder driven by a hydraulic actuator. Author (ESA)

N82-24212* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

ENVIRONMENTAL FOG/RAIN VISUAL DISPLAY SYSTEM FOR AIRCRAFT SIMULATORS Patent

Wendell D Chase, inventor (to NASA) Issued 2 Feb 1982 28 p Filed 29 Jun 1979 Supersedes N79-33220 (17 - 24 p 3180)

(NASA-Case-ARC-11158-1 US-Patent-4 313,726

US-Patent-Appl-SN-053566 US-Patent-Class-434-42,

US-Patent-Class-434-43) Avail US Patent and Trademark Office CSCL 14B

An environmental fog/rain visual display system for aircraft

simulators is described. The electronic elements of the system include a real time digital computer, a caligraphic color display which simulates landing lights of selective intensity, and a color television camera for producing a moving color display of the airport runway as depicted on a model terrain board. The mechanical simulation elements of the system include an environmental chamber which can produce natural fog, nonhomogeneous fog, rain and fog combined, or rain only. A pilot looking through the aircraft wind screen will look through the fog and/or rain generated in the environmental chamber onto a viewing screen with the simulated color image of the airport runway thereon and observe a very real simulation of actual conditions of a runway as it would appear through actual fog and/or rain.

Official Gazette of the U S Patent and Trademark Office

N82-24213* National Aeronautics and Space Administration Washington, D C

WIND TUNNELS OF THE INSTITUTE OF MECHANICS OF MOSCOW STATE UNIVERSITY

S M Gorlin ed and G E Khudyakov ed Apr 1982 150 p refs Transl into ENGLISH of 'Aerodinamicheskiye Truby Instituta Mekhaniki' Moscow, 1971 p 1-100 Transl by Franklin Book Programs, Inc Cairo, Egypt Original doc prep by Inst of Mechanics, Moscow State Univ (Contract NSF-C-724)

(NASA-TM-76909, NAS 1 15 76909, TT-78-58009) Avail NTIS HC A07/MF A01 CSCL 14B

The construction and characteristics of subsonic wind tunnels are described. Methods are presented on which are based the experimental works conducted on these installations. The data logs of the treatment of the results of experiments are also given. Author

N82-24214* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

ADAPTIVE WALL WIND-TUNNEL RESEARCH AT NASA-AMES RESEARCH CENTER

Edward T Schairer and Joel P Mendoza May 1982 16 p refs

(NASA-TM-84236, A-8893, NAS 1 15 84236) Avail NTIS HC A02/MF A01 CSCL 14b

Adaptive wall wind tunnel research is summarized. Small scale two and three dimensional wind tunnel experiments and numerical experiments with a three dimensional adaptive wall simulator are included. A NACA 0012 airfoil was tested in a 25 by 13 cm slotted wall test section. Airflow through the test section walls was controlled by adjusting the pressures in segmented plenums. Interference free conditions were successfully attained in subsonic and transonic flows. For the three dimensional experiment the 25 by 13 cm wind tunnel was modified to permit cross stream wall adjustments. The test model was a semispan wing mounted to one sidewall. Wall interference was substantially reduced at several angles of attack at Mach 0.60. A wing on wall configuration was also modeled in the numerical experiments. These flow simulations showed that free air conditions can be approximated by adjusting boundary conditions at only the floor and ceiling of the test section. No sidewall control was necessary. Typical results from these experiments are discussed. Author

N82-24301* National Aeronautics and Space Administration Langley Research Center, Hampton, Va

STANDARD TESTS FOR TOUGHENED RESIN COMPOSITES

May 1982 29 p refs

(NASA-RP-1092, L-15317, NAS 1 61 1092) Avail NTIS HC A03/MF A01 CSCL 11D

Several toughened resin systems are evaluated to achieve commonality for certain kinds of tests used to characterize toughened resin composites. Specifications for five tests were standardized, these test standards are described. S L

N82-24326* National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

A STATUS REVIEW OF NASA'S COSAM (CONSERVATION OF STRATEGIC AEROSPACE MATERIALS) PROGRAM Executive Status Report

Joseph R Stephens Washington May 1982 46 p refs

(NASA-TM-82852, E-1222, NAS 1 15 82852) Avail NTIS HC A03/MF A01 CSCL 11F

The use and supply of strategic elements in nickel base superalloys for gas turbine engines are reviewed. Substitution of

strategic elements, advanced processing concepts, and the identification of alternate materials are considered Cobalt, tantalum, columbium, and chromium, the supplies of which are 91-100% imported, are the materials of major concern J D

N82-24355# Southwest Research Inst San Antonio, Tex Energy Systems Research Div
IMPACT STUDY OF SYNTHETIC AND ALTERNATIVE FUEL USAGE IN ARMY AIRCRAFT PROPULSION SYSTEMS Final Report, Oct. 1980 - Jun. 1981

C A Moses and M I Valtierra Jul 1981 166 p refs Sponsored in part by the Army Mobility Research and Development Command

(Contract N00140-80-C-2269)

(AD-A111046, SwRI-MED134)

Avail NTIS

HC A08/MF A01 CSCL 21/4

The U S Army is concerned about the quality of future aircraft fuels and their compatibility with current engines and aircraft fuel systems This impact study of synthetic and alternate fuel usage on Army aircraft propulsion and fuel systems addresses four technical areas (1) The fuel scenario for Army aviation gas turbine fuels, (2) The effects of initial properties or the performance and durability of engine and fuel system components, (3) The identification of engines and fuel system components used in Army aircraft and their interface with the fuel, and (4) A review of qualification and certification procedures Author (GRA)

N82-24474# National Aeronautics and Space Administration Hugh L Dryden Flight Research Center, Edwards, Calif

ADAPTER FOR MOUNTING MICROPHONE FLUSH WITH THE EXTERNAL SURFACE OF THE SKIN OF A PRESSURIZED AIRCRAFT Patent Application

Robert B Cohn, inventor (to NASA) Filed 14 Dec 1981 14 p

(NASA-Case-FRC-11072-1, US-Patent-Appl-SN-330613) Avail NTIS HC A02/MF A01 CSCL 14B

A mounting device for securing a microphone pick-up head flush with respect to the external surfaces of the skin of an aircraft for detecting shock waves is described The mount includes a sleeve mounted internally of the aircraft for capturing and supporting an electronics package having the microphone pick-up head attached such that the head is flush with the external surface of the aircraft skin and a pressure seal is established between the internal and external surfaces of the aircraft skin

NASA

N82-24497# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

DEVELOPMENT OF HIGH-SPEED ROLLING-ELEMENT BEARINGS. A HISTORICAL AND TECHNICAL PERSPECTIVE

Erwin V Zaretsky 1982 28 p refs Presented at the SKF Seventy-Fifth Anniv Celebration Meeting, Nieuwegein, Netherlands, 9 Jun 1982, sponsored by SKF Research and Development Center

(NASA-TM-82884, E-1198 NAS 1 15 82884) Avail NTIS HC A03/MF A01 CSCL 13I

Research on large-bore ball and roller bearings for aircraft engines is described Tapered roller bearings and small-bore bearings are discussed Temperature capabilities of rolling element bearings for aircraft engines have moved from 450 to 589 K (350 to 600 F) with increased reliability High bearing speeds to 3 million DN can be achieved with a reliability exceeding that which was common in commercial aircraft Capabilities of available bearing steels and lubricants were defined and established Computer programs for the analysis and design of rolling element bearings were developed and experimentally verified The reported work is a summary of NASA contributions to high performance engine and transmission bearing capabilities R J F

N82-24500# National Aerospace Lab, Amsterdam (Netherlands) Bauweisen und Werkstoffe Hauptabt

COMPARISON BETWEEN PROBABILITY OF DETECTION, SENSITIVITY, AND ACCURACY OF FIVE NONDESTRUCTIVE INSPECTION METHODS

E A B deGraaf and P deRijk 25 Jun 1981 13 p refs In DUTCH, ENGLISH summary Presented at Europaesche Tagung fuer zerstoeungsfree Pruefung, Vienna, 14-16 Sep 1981 (NLR-MP-81038-U) Avail NTIS HC A02/MF A01

Approximately 200 high strength steel (AISI4340) aircraft undercarriage retraction cylinders, only part of which contained

fatigue tracks, were subjected to five different nondestructive tests by six inspectors Penetrants, ultrasonic flaw detection, eddy currents, and magnetic measurements were used Results of all these methods and inspectors were compared Considerable scattering in the results was observed The ultrasonic method reliability is low The results of fluorescent color penetration and eddy currents are moderate Due to its high reliability, magnetic inspection is preferred Author (ESA)

N82-24501# National Aeronautics and Space Administration Lewis Research Center, Cleveland Ohio

NONLINEAR STRUCTURAL AND LIFE ANALYSES OF A COMBUSTOR LINER

V Moreno (Pratt and Whitney Aircraft Group, East Hartford, Conn), G J Meyers (Pratt and Whitney Aircraft Group, East Hartford, Conn), A Kaufman, and G R Halford 1982 23 p refs Proposed for presentation at the Symp on Advances and Trends in Struct and Solid Mech, 4-7 Oct 1982, Washington, D C, sponsored by NASA and Georgetown Univ

(NASA-TM-82846 E-1216, NAS 1 15 82846) Avail NTIS HC A02/MF A01 CSCL 20K

Three dimensional, nonlinear finite element structural analyses were performed for a simulated combustor liner specimen to assess the capability of nonlinear analyses using classical inelastic material models to represent the thermoplastic creep response of the one half scale component Results indicate continued cyclic hardening and ratcheting while experimental data suggested a stable stress strain response after only a few loading cycles The computed stress strain history at the critical location was put into two life prediction methods, strainrange partitioning and a Pratt and Whitney combustor life prediction method to evaluate their ability to predict cyclic crack initiation It is found that the life prediction analyses over predicted the observed cyclic crack initiation life E A K

N82-24502# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

EVALUATION OF INELASTIC CONSTITUTIVE MODELS FOR NONLINEAR STRUCTURAL ANALYSIS

Albert Kaufman 1982 22 p refs Presented at the Symp on Nonlinear Constitutive Relations for High Temp Appl, Akron, Ohio, 19-20 May 1982, sponsored by NASA and Akron Univ (NASA-TM-82845, E-1215, NAS 1 15 82845) Avail NTIS HC A02/MF A01 CSCL 20K

The influence of inelastic material models on computed stress-strain states, and therefore predicted lives, was studied for thermomechanically loaded structures Nonlinear structural analyses were performed on a fatigue specimen which had been subjected to thermal cycling in fluidized beds and on a mechanically load cycled benchmark notch specimen Four incremental plasticity creep models (isotropic, kinematic, combined isotropic kinematic, combined plus transient creep) were exercised using the MARC program Of the plasticity models, kinematic hardening gave results most consistent with experimental observations Life predictions using the computed strain histories at the critical location with a strainrange partitioning approach considerably overpredicted the crack initiation life of the thermal fatigue specimen S L

N82-24512# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany)

REPORT FROM THE WORKING PARTY ON NEW FIBER MATERIALS [AUS DER ARBEIT DES ARBEITSKREISES NEUARTIGE FASERWERKSTOFFE (ANF)]

C Kensche 1981 12 p In GERMAN Presented at 5th Symp fuer Segelflugzeugentwicklung, Brunswick, 10-17 Nov 1981

Avail NTIS HC A02/MF A01

The aims, activities and achievements of a working party on new fiber composites are discussed Participants from industry and research institutions collaborated on the drafting of norms and specification sheets for these materials Further research items include experimentation test stands and standardization of test procedures Results on maximum yield stresses under tension, compression or shear are given for various specimens as well as in relation to fuselages or hulls Author (ESA)

N82-24514# Instituut TNO voor Werktuigkundige Constructies, Delft (Netherlands)

THE VIBRATORY BEHAVIOR OF A ROTATING PROPELLER

SHAFT. PART 4: VIBRATION TESTS OF A ROTATING PROPELLER SHAFT IN A RUBBER STERN TUBE BEARING

A J Francken and G C vanVelzen Dec 1980 80 p refs
(Contract A76/KM/134)
(IWECO-5072208-81-Pt-2, TDCK-75125-Pt-2) Avail NTIS
HC A05/MF A01

Lateral shaft vibration was tested by measuring shaft and bearing response to horizontal and vertical excitation. Results show no change in shaft position between the nonrotating and the rotating shaft at speeds up to 120 RPM. Resonance frequencies and driving point mobility deviate < 3% from reported values. Damping at 120 RPM amounts to 5% of critical damping at both resonances. Author (ESA)

N82-24620# Western Geophysical Co of America, Houston, Tex Aero Service Div

AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. IKPIKUP RIVER QUADRANGLE, ALASKA, VOLUME 2 Final Report

Feb 1981 108 p
(Contract DE-AC13-76GJ-01664)
(DE82-000314, GJBX-304-81-Vol-2) Avail NTIS
HC A06/MF A01

The flight path map, multiparameter profiles, histograms, and anomaly maps for uranium, thorium, potassium, uranium/potassium, uranium/thorium, d thorium/potassium are presented. Data was gathered during airborne gamma ray spectrometer and magnetometer survey flights over Alaska. DOE

N82-24629# Western Geophysical Co of America, Houston, Tex Aero Service Div

AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. JAMESTOWN QUADRANGLE, NORTH DAKOTA, VOLUME 1 Final Report

Mar 1981 85 p refs 2 Vol
(Contract DE-AC13-76GJ-01664)
(DE82-004150, GJBX-353-81-Vol-1) Avail NTIS
HC A05/MF A01

During the months of June through October, 1980 an airborne high sensitivity gamma-ray spectrometer and magnetometer survey over eleven 20 x 10 quadrangles located in the states of Minnesota and Wisconsin and seven 20 x 10 quadrangles in North and South Dakota was conducted. The results obtained over the Jamestown map area of North Dakota are discussed. The final data are presented in four different forms: on magnetic tape, on microfiche, in graphic form as profiles and histograms, and in map form as anomaly maps, flight path maps, and computer printer maps. DOE

N82-24630# Western Geophysical Co of America, Houston, Tex Aero Service Div

AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. JAMESTOWN QUADRANGLE, NORTH DAKOTA, VOLUME 2 Final Report

Mar 1981 100 p 2 Vol
(Contract DE-AC13-76GJ-01664)
(DE82-004169, GJBX-353-81-Vol-2) Avail NTIS
HC A05/MF A01

The flight path map, radiometric multiple-parameter stacked profiles, magnetic and ancillary parameter stacked profiles, histograms, anomaly maps for uranium, thorium, potassium, uranium/thorium, thorium/potassium, and uranium/potassium are given. Data was obtained during an airborne gamma-ray spectrometer and magnetometer survey of North Dakota. DOE

N82-24632# Western Geophysical Co of America, Houston, Tex Aero Service Div

AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. UMIAT QUADRANGLE, ALASKA, VOLUME 2 Final Report

Feb 1981 106 p refs 2 Vol
(Contract DE-AC13-76GJ-03664)
(DE82-000312, GJBX-305-81-Vol-2) Avail NTIS
HC A06/MF A01

The flight path map, multiparameter profiles, histograms, and anomaly maps are presented for uranium, thorium, potassium, uranium/potassium, uranium/thorium, and thorium/potassium. This data was obtained using an airborne gamma spectrometer and magnetometer. DOE

N82-24649*# Parsons (Ralph M.) Co., Pasadena, Calif FUEL QUALITY PROCESSING STUDY, VOLUME 1 Final Report

J B OHara, A Bela, N E Jentz, H T Syverson, H W Klumpe, R E Kessler, H T Kotzot and B L Loran Apr 1981 203 p refs 2 Vol

(Contracts DEN3-183, DE-A101-77ET-13111)
(NASA-CR-165327-Vol-1 DOE/NASA/O183-1, NAS 1 26 165327-Vol-1) Avail NTIS HC A10/MF A01 CSCL 21D

A fuel quality processing study to provide a data base for an intelligent tradeoff between advanced turbine technology and liquid fuel quality and also, to guide the development of specifications of future synthetic fuels anticipated for use in the time period 1985 to 2000 is given. Four technical performance tests are discussed: on-site pretreating, existing refineries to upgrade fuels, new refineries to upgrade fuels and data evaluation. The base case refinery is a modern Midwest refinery processing 200,000 BPD of a 60/40 domestic/import petroleum crude mix. The synthetic crudes used for upgrading to marketable products and turbine fuel are shale oil and coal liquids. Of these syncrudes, 50,000 BPD are processed in the existing petroleum refinery, requiring additional process units and reducing petroleum feed, and in a new refinery designed for processing each syncrude to produce gasoline, distillate fuels, resid fuels and turbine fuel, JPGs and coke. An extensive collection of synfuel properties and upgrading data was prepared for the application of a linear program model to investigate the most economical production slate meeting petroleum product specifications and turbine fuels of various quality grades. Technical and economic projections were developed for 36 scenarios, based on 4 different crude feeds to either modified existing or new refineries operated in 2 different modes to produce 7 differing grades of turbine fuels. A required product selling price of turbine fuel for each processing route was calculated. Procedures and projected economics were developed for on-site treatment of turbine fuel to meet limitations of impurities and emission of pollutants. R J F

N82-24650*# Parsons (Ralph M.) Co., Pasadena, Calif FUEL QUALITY/PROCESSING STUDY VOLUME 2 APPENDIX. TASK 1 LITERATURE SURVEY Final Report

J B OHara, A Bela, N E Jentz, H W Klumpe, H E Kessler, H T Kotzot, and B L Loran Apr 1981 274 p refs 2 Vol
(Contract DEN3-183, DE-A101-77ET-13111)

(NASA-CR-165327-Vol-2, DOE/NASA/O183-1, NAS 1 26 165327-Vol-2) Avail NTIS HC A12/MF A01 CSCL 21D

The results of a literature survey of fuel processing and fuel quality are given. Liquid synfuels produced from coal and oil shale are discussed. Gas turbine fuel property specifications are discussed. On-site fuel pretreatment and emissions from stationary gas turbines are discussed. Numerous data tables and abstracts are given. R J F

N82-24739# Societe Nationale Industrielle Aerospatiale, Toulouse (France) Acoustics Dept

AIRBUS INDUSTRY AND NOISE IN THE COMMUNITY

J Chaussonnet 7 Jan 1982 37 p Presented at Symp on Aircraft Noise Johannesburg, 21 Oct 1981, sponsored by South African Acoustic Inst

(SNIAS-821-111-111) Avail NTIS HC A03/MF A01

The contribution to the total perceived noise outside an aircraft during takeoff and landing, attributed to engines and the aerodynamics of the aircraft, is considered. Engine noise reduction by design, location of the engine, and by acoustic analysis of the nacelle is discussed. Aerodynamic noise reduction is treated in terms of aircraft design, operational procedures, and aircraft weight. The noise measurement facility used for checking operational procedures and measuring noise levels, is described. Results show that the acoustic noise of commercial aircraft can be significantly reduced. Author (ESA)

N82-24842# Societe Nationale Industrielle Aerospatiale, Toulouse (France) Service Controle Automatique du Vol

FLIGHT MANAGEMENT COMPUTER

J Grossin 7 Jan 1982 26 p In FRENCH Presented at Soc des Electriciens et des Radioelectriciens (SEE), Nice, 26 Nov 1981 Submitted for Publication

(SNIAS-821-111-110) Avail NTIS HC A03/MF A01

Ways in which automatic flight control can reduce fuel consumption were investigated. Three domains were identified.

(1) thrust optimization, (2) optimization of in-flight aerodynamic configuration, and (3) flight plan optimization. The use of flight management computers to achieve these goals is discussed and recently developed equipment is depicted. System design and functions are explained. The choice of performance optimization criteria (cost index) is considered. How a flight management computer deals with horizontal navigation is treated as an example. Author (ESA)

N82-24845*# Research Triangle Inst., Research Triangle Park, N C. Systems and Measurements Div.
PRODUCTION OF RELIABLE FLIGHT CRUCIAL SOFTWARE: VALIDATION METHODS RESEARCH FOR FAULT TOLERANT AVIONICS AND CONTROL SYSTEMS SUB-WORKING GROUP MEETING

J R Dunham, ed and J C Knight, ed (Virginia Univ.) May 1982. 27 p. refs. Meeting held at Research Triangle Park, N C, 2-4 Nov 1981.

(NASA-CP-2222, L-15291, NAS 1 55 2222) Avail NTIS HC A03/MF A01 CSCL 09B

The state of the art in the production of crucial software for flight control applications was addressed. The association between reliability metrics and software is considered. Thirteen software development projects are discussed. A short term need for research in the areas of tool development and software fault tolerance was indicated. For the long term, research in formal verification or proof methods was recommended. Formal specification and software reliability modeling, were recommended as topics for both short and long term research. NW

N82-24846*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
COMBINING ANALYSIS WITH OPTIMIZATION AT LANGLEY RESEARCH CENTER. AN EVOLUTIONARY PROCESS

James L Rogers, Jr. Apr 1982. 11 p. refs. Proposed for presentation at the 2nd Intern. Computer Eng. Conf. and Show, San Diego, Calif., 15-19 Aug 1982.

(NASA-TM-84472, NAS 1 15 84472) Avail NTIS HC A02/MF A01 CSCL 09B

The evolutionary process of combining analysis and optimization codes was traced with a view toward providing insight into the long term goal of developing the methodology for an integrated, multidisciplinary software system for the concurrent analysis and optimization of aerospace structures. It was traced along the lines of strength sizing, concurrent strength and flutter sizing, and general optimization to define a near-term goal for combining analysis and optimization codes. Development of a modular software system combining general-purpose, state-of-the-art, production-level analysis computer programs for structures, aerodynamics, and aeroelasticity with a state-of-the-art optimization program is required. Incorporation of a modular and flexible structural optimization software system into a state-of-the-art finite element analysis computer program will facilitate this effort. This effort results in the software system used that is controlled with a special-purpose language communicates with a data management system, and is easily modified for adding new programs and capabilities. A 337 degree-of-freedom finite element model is used in verifying the accuracy of this system. M D K

N82-24942*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio

AEROACOUSTIC PERFORMANCE OF AN EXTERNALLY BLOWN FLAP CONFIGURATION WITH SEVERAL FLAP NOISE SUPPRESSION DEVICES

Daniel J McKinzie, Jr. May 1982. 30 p. refs.

(NASA-TP-1995 E-573 NAS 1 60 1995) Avail NTIS HC A03/MF A01 CSCL 20A

Small scale model acoustic experiments were conducted to measure the noise produced in the flyover and sideline planes by an engine under the wing externally blown flap configuration in its approach attitude. Broadband low frequency noise reductions as large as 9 dB were produced by reducing the separation distance between the nozzle exhaust plane and the flaps. Experiments were also conducted to determine the noise suppression effectiveness in comparison with a reference configuration of three passive types of devices that were located on the jet impingement surfaces of the reference configuration. These devices produced noise reductions that varied up to 10 dB at reduced separation distances. In addition, a qualitative estimate of the noise suppression characteristics of the separate devices was made. Finally static aerodynamic performance data were

obtained to evaluate the penalties incurred by these suppression devices. The test results suggest that further parametric studies are required in order to understand more fully the noise mechanisms that are affected by the suppression devices used. MG

N82-24946# Office National d'Etudes et de Recherches Aérospatiales, Paris (France)

GENERATION OF NOISE BY TURBULENCE

Robert Legendre. 1981. 35 p. refs. In FRENCH ENGLISH summary. Report will also be announced as translation (ESA-TT-763).

(ONERA-P-1981-3, ISSN-0078-379X) Avail NTIS HC A03/MF A01

The notion of noise source is elaborated, distinguishing between turbulent agitation, which is a cause, and acoustic agitation which is a minor effect or subproduct whose essential particularity is its propagation at the speed of sound. This allows for a precise definition of noise, derived from acoustic potential and apart from pseudo-noise linked to turbulence. The equation, valid for this potential, is established by an almost complete elimination of state variables and is linearized. This enables a study of convection and refraction effects and shows that generated noise is in proportion to the density relative variation rate. A model of anisotropic turbulence inside a shear flow is proposed. Its use shows that the noise generated inside a vortex tube is proportional to the square of the circulation. Application of the findings to interpretation of noise measurements in wind tunnels, e.g. aircraft noise predictions, is discussed. An extension of the method in order to include noise near obstacles is outlined. Author (ESA)

N82-25017*# National Aeronautics and Space Administration, Washington, D C. Education Services Branch

AEROSPACE ENGINEERS. WE'RE TOMORROW-MINDED PEOPLE

Mary H Lewis. 1981. 39 p. refs. Original contains color illustrations.

(NASA-EP-188, NAS 1 19 188) Avail NTIS HC A03/MF A01 CSCL 05A

Brief job-related autobiographical sketches of engineers working on NASA aerospace projects are presented. Career and educational guidance is offered to students thinking about entering the aerospace field. R J F

N82-25040*# Arizona Univ., Tucson. Optical Sciences Center

TESTING OF THE KUIPER AIRBORNE OBSERVATORY 91-CM TELESCOPE. Final Report

Robert E Parks. Jul 1979. 49 p. refs.

(Contract NAS2-10085)

(NASA-CR-166341, NAS 1 26 166341) Avail NTIS HC A03/MF A01 CSCL 03A

The 91 cm telescope of the Kuiper Airborne Observatory was tested for optical figure errors in the surface of the mirrors and misalignment of the optical components. When the present set of optical components are installed in the telescope in proper alignment, the telescope produces an image with 80% of the energy in a circle of 1.50 arc seconds in diameter, that is, a 0.11 mm spot diameter in the focal plane. The primary mirror, an f/2 parabola, was tested against a flat and has a quality that puts 80% of the energy in a 0.51 arc second diameter spot. Two principal sources account for the residual error: the tertiary folding flat and the chopping secondary. It appears that the method of mounting the folding flat causes some distortion and that the secondary mirror has some residual spherical aberration in its figure. S L

N82-25170*# Grumman Aerospace Corp., Bethpage, N Y
STUDY OF VTOL IN GROUND-EFFECT FLOW FIELD INCLUDING TEMPERATURE EFFECT. Final Report

W G Hill, R C Jenkins, S G Kalemans, and M J Siclari. Apr 1982. 179 p. refs.

(Contract NAS2-10645)

(NASA-CR-166258, NAS 1 26 166258) Avail NTIS HC A09/MF A01 CSCL 01A

Detailed pressure, temperature and velocity data were obtained for twin-fan configurations in-ground-effect and flow models to aid in predicting pressures and upwash forces on aircraft surfaces were developed. For the basic experiments, 49.5 mm-diameter jets were used, oriented normal to a

simulated round plane, with pressurized, heated air providing a jet. The experimental data consisted of (1) the effect of jet height and temperature on the ground, model, and upwash pressures and temperatures, (2) the effect of simulated aircraft surfaces on the isolated flow field, (3) the jet-induced forces on a three-dimensional body with various strakes, (4) the effects of non-uniform coannular jets. For the uniform circular jets, temperature was varied from room temperature (24 C) to 232 C. Jet total pressure was varied between 9,300 Pascals and 31,500 Pascals. For the coannular jets, intended to represent turbofan engines, fan temperature was maintained at room temperature while core temperature was varied from room temperature to 437 C. Results are presented. B W

N82-25171# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt Brunswick (West Germany) Inst fuer Flugfuehrung

PROCEEDINGS OF THE 11TH SYMPOSIUM ON AIRCRAFT INTEGRATED DATA SYSTEMS

Nov 1981 454 p refs Symp held at Cologne, 22-24 Sep 1981

(DFVLR-Mitt-82-02) Avail NTIS HC A20/MF A01 DFVLR Cologne DM 122 90

The acquisition and processing of in-flight data are discussed. Flight recorder design and usefulness, cost benefits of improved data systems, trends in data system engineering are considered. Aircraft accident investigation and maintenance as well as engine monitoring are covered. For individual titles see N82-25172 through N82-25189.

N82-25172# Sperry Univac, St Paul Minn

SOLID-STATE FLIGHT INCIDENT RECORDER

D Amundson /in DFVLR Proc of the 11th Symp on Aircraft Integrated Data Systems Nov 1981 p 17-31 refs

Avail NTIS HC A20/MF A01 DFVLR, Cologne DM 122,90

A deployable flight incident recorder based on MNOS technology, suitable for fighter aircraft, is described. Capable of recording 30 min of digital and 15 min of audio information, the equipment weighs 3.5 lbs and dissipates 3.5 W. Flight and crash tests show that it is more reliable than tape recorders, and improves access times a million-fold. If audio is not required, engine monitoring, aircraft fatigue recording and program storage for onboard computers are possible. Author (ESA)

N82-25173# Hamilton Standard Windsor Locks Conn

SOLID STATE CRASH SURVIVABLE FLIGHT DATA RECORDERS FOR MISHAP INVESTIGATION

H R Ask /in DFVLR Proc of the 11th Symp on Aircraft Integrated Data Systems Nov 1981 p 33-68 refs

Avail NTIS HC A20/MF A01 DFVLR, Cologne DM 122 90

The state of the art in solid state memories, microprocessors and crash survival is reviewed. Flight recorders for small and large civil transport aircraft are described. Heat flow problems with crash survivable designs are solved, using an intumescent outer layer for the enclosure. This provides heat absorption during a phase change, followed by creation of a passive insulation layer formed by the charred residue. An aluminum alloy housing under the intumescent layer is the primary rigid structure for penetration, shock and static crush resistance. The small aircraft system has a 131 kbit memory providing 30 min of prior flight data with > 100% reserve, using data compression. It protects airborne and on ground signal goodness data and is nondeployable. The large aircraft system stores the 21 min of raw input data and the last 15 hr of data in memory with data compression possible. It protects in memory two flight cycles of any duration, with total elapsed time > 25 hr possible. Author (ESA)

N82-25174# Sundstrand Data Control Inc., Redmond Wash

NEW TECHNIQUES IN DATA RETRIEVAL AND DISPLAY

G S L Benn /in DFVLR Proc of the 11th Symp on Aircraft Integrated Data Systems Nov 1981 p 69-91 refs

Avail NTIS HC A20/MF A01 DFVLR, Cologne DM 122 90

The contribution of multicolor graphics to the display and interpretation of aircraft data from digital flight data recorders is described. Video graphic techniques for improving the speed of data interpretation and methods that allow rapid quick look selected data are compared with previous methods. For a noncrash incident, a two page printout of relevant parameters, photographs

via the screen print of the last hour of flight together with zoomed detail of the incident, and a permanent record of flight data are available in < one hour. Quick look capability is ensured by electronic scrolling of graphed data coupled with direct conversion of digital data to engineering units. Author (ESA)

N82-25175# Eurocontrol Agency, Brussels (Belgium)

ON-LINE EXPERIMENTS IN ACQUIRING AND EXPLOITING AIDS DATA FOR ATC PURPOSES

M E Cox /in DFVLR Proc of the 11th Symp on Aircraft Integrated Data Systems Nov 1981 p 93-114 refs

Avail NTIS HC A20/MF A01 DFVLR, Cologne DM 122,90

Problems in acquiring real time data from aircraft integrated data systems are discussed. The experimental evaluation of AIDS data applications and investigation of a functional system are described. Flight tests indicate that the acquisition of aircraft data via a selectively addressed secondary surveillance radar mode S transponder is straightforward if an ARINC 429 Mk 33 digital information transfer system interface is available. Author (ESA)

N82-25176# Vereinigung Cockpit Frankfurt am Main (West Germany)

A PILOT'S VIEW ON POSSIBLE USES OF AIDS

Christian Denke /in DFVLR Proc of the 11th Symp on Aircraft Integrated Data Systems Nov 1981 p 125-130

Avail NTIS HC A20/MF A01 DFVLR, Cologne DM 122,90

Problems with the US beacon collision avoidance system and the Eurocontrol - DFVLR airborne link terminal are highlighted. The US system cannot handle a large number of aircraft, and resolves encounters through distance and flight level, with no reference to relative position. Avoidance maneuvers are only possible in the vertical plane. The avoidance maneuver logic has not been proven capable of accounting for individual aircraft performance. The European system substitutes visual messages for voice communication, increasing the already considerable visual workload. Its insistence on rigidly adhering to flight plans (as an aid to strategic ATC) increases fuel costs. Author (ESA)

N82-25177# Sundstrand Data Control, Inc., Redmond Wash

A NEW ALL-PURPOSE DIGITAL FLIGHT DATA RECORDER

P H Eason /in DFVLR Proc of the 11th Symp on Aircraft Integrated Data Systems Nov 1981 p 131-158 ref

Avail NTIS HC A20/MF A01 DFVLR, Cologne DM 122,90

A recorder which can be installed interchangeably in ARINC 542 or ARINC 573/717 equipped aircraft features a coplanar, peripheral belt driven magnetic tape transport containing 450 ft of 1/4 in tape. Two interleaved 4-channel read/write heads and two erase heads are incorporated. A 7.5 deg external drive step motor operating in a slew mode drives the tape at 6 ips. The electronics cards are standard plug in boards containing read/write, transport, data acquisition, data acquisition expansion, and aircraft wiring interfaces, as well as the recording system and data acquisition controllers. The built in test capability exceeds 95% fault detection. Author (ESA)

N82-25178# Air Navigation Services Inc., Westerngrund (West Germany)

Advisory Group

AERONAUTICAL INFORMATION DATA SUBSYSTEMS

Frank W Fischer /in DFVLR Proc of the 11th Symp on Aircraft Integrated Data Systems Nov 1981 p 159-184 refs

Avail NTIS HC A20/MF A01 DFVLR, Cologne DM 122,90

The case for reorganizing aeronautical information processing is argued. Air traffic controllers need access to correct, current, definitive data on activity in their area. Since they have to make real time decisions, systems must provide information in a rapidly assimilable and retransmissible form. A centralized data source is required to preprocess data. Author (ESA)

N82-25179# Dayton Univ Ohio Research Inst

THE EFFECT OF VERY HEAVY RAIN UPON AIRCRAFT AND ITS ROLE IN WIND SHEAR ATTRIBUTED ACCIDENTS

P A Haines and J K Luers /in DFVLR Proc of the 11th Symp on Aircraft Integrated Data Systems Nov 1981 p 185-215 refs

Avail NTIS HC A20/MF A01 DFVLR, Cologne DM 122,90

N82-25180

Theoretical and experimental analyses of the effects of very heavy rain on aircraft performance are summarized. Analysis reveals momentum loss, increased drag, and reduced lift resulting from cratering of the rainwater film on airfoils by raindrops. Momentum penalties were derived from a combined drop trajectory/potential flow analysis. The derived penalties were introduced into a digital flight simulation program and the effect of very heavy rain was compared to that of wind shear by performing landings in combinations of wind, rain, no wind, and no rain. Results show that the derived wind shears of accident reconstructions are too large because a significant part of the loss in indicated airspeed is caused by rain. Author (ESA)

N82-25180# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany) Forschungszentrum

THE DFVLR DIGITAL FLIGHT DATA READOUT AND PROCESSING STATION AND ITS UTILITY

H Hardegen /In its Proc of the 11th Symp on Aircraft Integrated Data Systems Nov 1981 p 217-245

Avail NTIS HC A20/MF A01, DFVLR, Cologne DM 122.90

Efforts to meet aviation authority requirements, scientific interest, and commercial requests at a flight data readout and processing station are described with emphasis on bit rates, data fault correction, and reduction of data loss during transcription and reformatting. Regenerated data are recorded on computer tape and an eight-channel plot which provides a quick look the preceding flight history during regeneration is produced. All the computer programs are modular. After the program is started, the initial and final blocks are requested as the parameters to be calculated. Conversion from digital to engineering units is checked manually. Data losses are easily localized by counting the frames per minute and checking the synchronization words. Author (ESA)

N82-25181# Lufthansa German Airlines, Hamburg (West Germany)

SIDSLIP INDICATION SYSTEM AS A FUEL SAVING AID IN JET TRANSPORT AIRCRAFT OPERATION

Dieter Horst /In DFVLR Proc of the 11th Symp on Aircraft Integrated Data Systems Nov 1981 p 247-275

Avail NTIS HC A20/MF A01, DFVLR, Cologne DM 122.90

The relationship between sideslip angle heading constant, and roll angle is outlined and a sideslip sensor is described. A conical pressure sensing probe extends through the fuselage perpendicular to the local air flow. Unequal pressure arising from sideslip causes two paddle blades to rotate the probe until pressure on each paddle is equal, i.e., until the probe is realigned with the airstream. During rotation output elements attached to the probe are also rotated, providing electrical signals proportional to sideslip angle to an indicator. Tests on an A-300 Airbus show that avoiding sideslip cuts fuel consumption by 0.2%. Author (ESA)

N82-25182# Societe de Fabrication d'Instruments de Mesure SFIM, Massy (France)

AN INTERMEDIATE SOLUTION BETWEEN BASIC AND EXPANDED AIRCRAFT INTEGRATED DATA SYSTEMS (AIDS)

C35
Claude Robert /In DFVLR Proc of the 11th Symp on Aircraft Integrated Data Systems Nov 1981 p 277-300 refs

Avail NTIS HC A20/MF A01, DFVLR, Cologne DM 122.90

A single digital flight data acquisition and management unit, divided for reliability into two parts, is proposed as an alternative to ARINC 717. One part deals with mandatory parameters which are sampled, coded and transmitted in a PCM stream to the digital flight data recorder. The second part processes the parameters and is user programmable. Analysis consists of exceedance processing (e.g. engine nacelle) gas pass analysis, AIDS monitoring and aircraft system warning from the flight warning computer. Airline response indicates that this system meets their requirements. Author (ESA)

N82-25183# Lockheed Aircraft Service, Inc., Ontario, Calif
FLIGHT DATA RECOVERY UNDER ADVERSE CONDITIONS

E J Rosenbauer /In DFVLR Proc of the 11th Symp on Aircraft Integrated Data Systems Nov 1981 p 301-322 ref

Avail NTIS HC A20/MF A01, DFVLR, Cologne DM 122.90

Methods for overcoming data loss including bit dump, bit shift, forward and reverse readout, time displacement compensation (TDC), wideband TDC, and supersynchronization are discussed. Supersynchronization systems recognize acquisition of any one sync word as an in-sync condition and process accordingly. They open a window prior to the end of the subframe which enables the circuit to look for the next sync work up to 8 bits early. A feedback loop enables one shot timing methods to track the average bit rate automatically. A time duration equal to 70.7% of the average bit period is recommended. A digital bit averaging technique in which the bit decision time is determined by the average of the two previous bits, gives excellent results. With forward and reverse processing data are processed in the usual way through the engineering conversion process. Valid data, prior to the out of sync area, look normal. The computer then goes to the end of the subframe and processes data from this point backwards toward the sync loss area. Author (ESA)

N82-25184# United Technologies Corp., Windsor Locks, Conn
GAS PATH ANALYSIS OF COMMERCIAL AIRCRAFT ENGINES

Louis A Urban /In DFVLR Proc of the 11th Symp on Aircraft Integrated Data Systems Nov 1981 p 323-357

Avail NTIS HC A20/MF A01, DFVLR, Cologne DM 122.90

A mathematical means of determining overall engine performance, individual module performance and sensor performance from any specified set of engine parameters is introduced. If $Z_e = H_e X_e$ where Z_e is a set of engine measurement deltas, X_e is a set of engine module deviations and H_e is a set of partial derivatives, interrelating the two sets, it follows that X_e can be solved for by taking the product of Z_e times the inverse of H_e (the diagnostic matrix). A maximum likelihood estimation technique ensures that measurements are noise free. Operating mode can include in-flight or ground-based analysis. Airline experience shows that gas path analysis is cost effective and technically sound. Author (ESA)

N82-25185# Technische Universitaet Brunswick (West Germany) Lehrstuhl fuer Flugmechanik

GROUND SPEED MEASUREMENT FROM DME/VHF OMNIRANGE NAVIGATION (VOR) DATA

P Voersmann /In DFVLR Proc of the 11th Symp on Aircraft Integrated Data Systems Nov 1981 p 359-380 refs

Avail NTIS HC A20/MF A01, DFVLR, Cologne DM 122.90

Off-line computer results of DME/VOR ground speed are compared with data from an airborne inertial navigation system platform. Signal properties of DME/VOR data are discussed, and requirements for filtering the data are stated. Best agreement between the two systems (within 2 knots) is achieved when the aircraft is flying on a constant radial, i.e., when the radial ground speed is negligibly small. Oscillation of the radial ground speed component around low frequencies is attributed to hardware limitations. Author (ESA)

N82-25186# British Aluminum Co., Ltd., London (England)
GATHERING AND ANALYSING DATA ON THE BRITISH AIRWAYS BOEING 757 AIRCRAFT

Peter Waller /In DFVLR Proc of the 11th Symp on Aircraft Integrated Data Systems Nov 1981 p 381-393

Avail NTIS HC A20/MF A01, DFVLR, Cologne DM 122.90

The maintenance and operational benefits of a data system connected to 24 serial digital data paths between avionics units are described. The set up includes a quick access recorder with on board playback capability, using a printer-plotter on the flight deck. A single unit collects, processes and distributes parameters. Separate processors handle the mandatory and integrated data system operations. Any parameter can be displayed, call up being through a simple mnemonic. Routine evaluation programs monitor flight operations, propulsion units, autoland performance and integrity, fuel performance, and the autoflight system. Engineers can request a printout of the times at which defined points of the flight occurred, and use these to define the time at which reported incidents happened. The relevant parameters for this, and adjacent times are quickly available. Author (ESA)

N82-25188# Leigh Instruments Ltd., Carleton Place (Ontario)
VALUE OF SURVIVABILITY AND RECOVERABILITY OF

FLIGHT DATA RECORDERS

James W Wells and W Donald Wells *In* DFVLR Proc of the 11th Symp on Aircraft Integrated Data Systems Nov 1981 p 419-440 refs

Avail NTIS HC A20/MF DFVLR Cologne DM 122.90

Alternative design approaches to provide survival recorded flight information offer different degrees of effectiveness. The method of protecting recorded information selected in a given application should be that which provides the most economically effective capability. The value of accident information is derived from its usefulness in accident prevention. Capability and design trades for survivability versus contributions to usefulness of information is considered in terms of economic measurement. A method is outlined for assessing recorder survivability and recoverability direct benefits, (reduced cost of investigating accident or criminal intent) and bottom line benefits (reduction of aircraft grounding expenses or reduction of fault correction cost by more reliable data inputs) A R H

N82-25189# British Aluminum Co., Ltd., London (England)
ANALYSIS OF TRANSIENT DATA FROM AIRCRAFT GAS TURBINE ENGINES USING AIDS

E R White *In* DFVLR Proc of the 11th Symp on Aircraft Integrated Data Systems Nov 1981 p441-453

Avail NTIS HC A20/MF A01 DFVLR, Cologne DM 122.90

Takeoff margin trending is used to illustrate engine monitoring, using in-flight data. For each takeoff, engine pressure ratio (EPR) data are collected at 80 knots, and the peak turbine temperature prior to liftoff is modified by an amount equal to any subsequent throttle movement. Total air temperature at 100 knots is converted to a static air temperature by subtracting an amount equivalent to the ram rise. Peak turbine temperature is corrected to ISA conditions then for EPR to a full rated takeoff level. This gives the turbine temperature that the engine would have produced at a full rated thrust under ISA conditions. The corrected temperature is subtracted from the red line limit, giving a margin which is plotted as a historical trend. These margins agree almost exactly with ground run data.

Author (ESA)

N82-25192# Stellenbosch Univ (South Africa) Dept of Engineering

PREDICTION OF WING SIDE-EDGE SUCTION FORCES AND MAXIMUM INVISCID LIFT Ph.D Thesis

C Redelinghuys Sep 1981 244 p refs

Avail NTIS HC A11/MF A01

The possibility of predicting the characteristics of low aspect-ratio wings theoretically is investigated. A literature survey on theoretical techniques for edge separated flows, vortex breakdown and maximum theoretical wing lift is presented. It is shown that prediction of the maximum theoretical lift by means of the suction analogy leads to results which differ from those obtained by means of previous techniques. Comparisons with experiment shows that low aspect ratio rectangular wings do achieve lift coefficients close to the theoretical maximum value. A new method, based on Lan's quasi-vortex-lattice method and the suction analogy, is developed for the prediction of the aerodynamics of unconventional planforms. Author

N82-25193# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

AN ANALYTICAL PROCEDURE FOR COMPUTING SMOOTH TRANSITIONS BETWEEN TWO SPECIFIED CROSS SECTIONS WITH APPLICATIONS TO BLENDED WING BODY CONFIGURATION

Raymond L Barger May 1982 20 p refs

(NASA-TP-2012, L-15053 NAS 160 2012) Avail NTIS HC A02/MF A01 CSCL 01A

An analytical procedure is described for designing smooth transition surfaces for blended wing-body configurations. Starting from two specified cross section shapes, the procedure generates a gradual transition from one cross section shape to the other as an analytic blend of the two shapes. The method utilizes a conformal mapping, with subsequent translation and scaling, to transform the specified and shapes to curves that can be combined more smoothly. A sample calculation is applied to a blended wing-body missile type configuration with a top mounted inlet.

S L

N82-25194# Boeing Commercial Airplane Co., Seattle, Wash
A HARMONIC ANALYSIS METHOD FOR UNSTEADY

TRANSONIC FLOW AND ITS APPLICATION TO THE FLUTTER OF AIRFOILS Final Report

F Edward Ehlers and Warren H Weatherill Washington NASA May 1982 151 p refs

(Contract NAS1-15957)

(NASA-CR-3537, NAS 126 3537, D6-49821) Avail NTIS HC A08/MF A01 CSCL 01A

A finite difference method for solving the unsteady transonic flow about harmonically oscillating wings is investigated. The procedure is based on separating the velocity potential into steady and unsteady parts and linearizing the resulting unsteady differential equation for small disturbances. The differential equation for the unsteady velocity potential is linear with spatially varying coefficients and with the time variable eliminated by assuming harmonic motion. A study is presented of the shock motion associated with an oscillating airfoil and its representation by the harmonic procedure. The effects of the shock motion and the resulting pressure pulse are shown to be included in the harmonic pressure distributions and the corresponding generalized forces. Analytical and experimental pressure distributions for the NACA 64A010 airfoil are compared for Mach numbers of 0.75, 0.80 and 0.842. A typical section, two-degree-of-freedom flutter analysis of a NACA 64A010 airfoil is performed. The results show a sharp transonic bucket in one case and abrupt changes in instability modes. Author

N82-25196# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

WIND-TUNNEL/FLIGHT CORRELATION, 1981

L Wayne McKinney, ed and Donald D Baals, ed Jun 1982 224 p refs Workshop held at Hampton, Va, 19-20 Nov 1981

(NASA-CP-2225, L-15368, NAS 155 2225) Avail NTIS HC A10/MF A01 CSCL 14B

Wind-tunnel/flight correlation activities are reviewed to assure maximum effectiveness of the early experimental programs of the National Transonic Facility (NTF). Topics included a status report of the NTF, the role of tunnel-to-tunnel correlation, a review of past flight correlation research and the resulting data base, the correlation potential of future flight vehicles, and an assessment of the role of computational fluid dynamics.

N82-25197# National Aeronautics and Space Administration Langley Research Center Hampton, Va

STATUS OF THE NATIONAL TRANSONIC FACILITY

Robert L Swain *In* its Wind-Tunnel/Flight Correlation, 1981 Jun 1982 p 1-21

Avail NTIS HC A10/MF A01 CSCL 14B

Construction status of major tunnel systems/subsystems of the National Transonic Facility, an advanced high Reynolds number capability wind tunnel utilizing cryogenic nitrogen as the fluid medium is presented. NW

N82-25198# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

REVIEW OF THE 1980 WIND-TUNNEL/FLIGHT CORRELATION PANEL

Theodore G Ayers *In* NASA Langley Research Center Wind-Tunnel/Flight Correlation, 1981 Jun 1982 p 23-32 refs

Avail NTIS HC A10/MF A01 CSCL 01A

Wind tunnel/flight correlation history from the P-51 to the F-8 supercritical wing is reviewed, showing that researchers continue to be faced with nearly identical discrepancies in predicted versus measured drag. The capabilities of the National Transonic Facility to allow assessment of the effects which have heretofore plagued researchers and aircraft designers are anticipated. NW

N82-25199# Lockheed-Georgia Co., Marietta

WIND-TUNNEL/FLIGHT-DRAG CORRELATION

John H Peterson *In* NASA Langley Research Center Wind-Tunnel/Flight Correlation, 1981 Jun 1982 p 33-46 refs

Avail NTIS HC A10/MF A01 CSCL 01A

Predicted and flight-test drag on the C-5A and the C-141 are correlated. Equivalent rigid flight-test profile drag and a rigid estimate based on wind tunnel data are also correlated. Correlations for the National Transonic Facility are included. NW

N82-25200

N82-25200*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
TUNNEL-TO-TUNNEL CORRELATION
Frank W Steinle, Jr /In NASA Langley Research Center
Wind-Tunnel/Flight Correlation 1981 Jun 1982 p 47-63 refs

Avail NTIS HC A10/MF A01 CSCL 01A

Flow quality is discussed. Incremental comparisons of (1) the angle of attack (2) the axial force coefficient and (3) the base cavity axial force coefficient against the normal force coefficient are presented. Relative blockage determination, relative buoyancy corrections, and boundary layer transition length are discussed. Blockage buoyancy caused by tunnel model wall dynamic interaction is discussed in terms of adaptive walls. The effect of transonic turbulence factor is considered. NW

N82-25201*# National Aeronautics and Space Administration
Langley Research Center, Hampton, Va
WIND-TUNNEL/FLIGHT CORRELATION PROGRAM ON XB-70-1

John B Peterson Jr /In its Wind-Tunnel/Flight Correlation, 1981 Jun 1982 p 65-91 refs

Avail NTIS HC A10/MF A01 CSCL 01A

The XB-70-1 was selected for a wind-tunnel/flight correlation program as representative of a large, flexible supersonic airplane similar to a supersonic transport. Tests were made to determine the effects of control deflections, wing tip deflection, and variations in inlet mass flow (additive drag). NW

N82-25202*# National Aeronautics and Space Administration
Langley Research Center, Hampton, Va
PROBLEMS IN CORRELATION CAUSED BY PROPULSION SYSTEMS

Ronald H Smith /In its Wind-Tunnel/Flight Correlation, 1981 Jun 1982 p 93-108 ref

Avail NTIS HC A10/MF A01 CSCL 01A

Correlation efforts and selected results for transonic drag are reviewed. A process to reduce the typical error sources to decrease the errors inherent in the transonic aircraft development process is summarized. Author

N82-25203*# McDonnell Aircraft Co., St. Louis, Mo
F-15 WIND-TUNNEL/FLIGHT CORRELATIONS
Larry G Niedling /In NASA Langley Research Center
Wind-Tunnel/Flight Correlation, 1981 Jun 1982 p 109-115 refs

Avail NTIS HC A10/MF A01 CSCL 01A

F-15 correlation data for longitudinal control and inlet-ramp effectiveness, and horizontal-tail setting for trim are presented. The Reynolds number effect on airfoil laminar bubble burst is included. NW

N82-25206*# Boeing Commercial Airplane Co., Seattle, Wash
OPPORTUNITIES FOR WIND-TUNNEL/FLIGHT CORRELATION WITH NEW BOEING AIRPLANES
Adelbert L Nagel /In NASA Langley Research Center
Wind-Tunnel/Flight Correlation 1981 Jun 1982 p 141-157

Avail NTIS HC A10/MF A01 CSCL 01A

The use of correlated data in airplane development is discussed. Areas of interest include initial airworthiness of an aircraft low-speed configuration optimization and high-speed configuration optimization. Data from wind tunnel tests are shown to be significant when applied to guarantee compliance which includes fuel consumption, airspeeds, and takeoff and landing performance. The use of correlation in achieving FAA certification is also discussed. TM

N82-25207*# General Dynamics/Fort Worth, Tex
F-16E PROGRAM OVERVIEW AND WIND TUNNEL/FLIGHT CORRELATION

A P Madsen /In NASA Langley Research Center Wind-Tunnel/Flight Correlation 1981 Jun 1982 p 159-172 ref

Avail NTIS HC A10/MF A01 CSCL 01A

Correlation is defined in three different ways: comparisons of wind tunnel and/or theory with flight results, detailed studies of total vehicle drag from wind tunnel and flight tests, and attempts to understand the fundamental mechanisms of fluid

flows associated with aircraft components in specific areas of the flight environment. The F-16E configuration is an outgrowth of studies conducted to produce a refined fighter wing design. Several iterations required to arrive at the combination of wing planform, camber, and twist which gives near optimum lift, drag, and high-angle-of-attack stability. Theoretical analyses were backed up by extensive experimental data to validate the design and are presented. TM

N82-25209*# Grumman Aerospace Corp., Bethpage, NY
X-29A FORWARD-SWEPT-WING DEMONSTRATOR AIRPLANE

Douglas R Frei /In NASA Langley Research Center Wind-Tunnel/Flight Correlation, 1981 Jun 1982 p 177-189

Avail NTIS HC A10/MF A01 CSCL 01A

The X-29A is a technology demonstrator. The FSW is just one of the technologies. Others include the following: discrete variable camber, relaxed static stability, triplex digital fly-by-wire (FBW) control system, variable-incidence/close-coupled canard, aeroelastically tailored composite wing, and thin supercritical airfoil. The growth potential for additional technologies is shown. TM

N82-25211*# Massachusetts Inst of Tech., Cambridge
APPLICATION OF COMPUTATIONAL FLUID DYNAMICS (CFD) IN TRANSONIC WIND-TUNNEL/FLIGHT-TEST CORRELATION

Earl M Murman /In NASA Langley Research Center Wind-Tunnel/Flight Correlation, 1981 Jun 1982 p 199-215 refs

Avail NTIS HC A10/MF A01 CSCL 01A

The capability for calculating transonic flows for realistic configurations and conditions is discussed. Various phenomena which were modeled are shown to have the same order of magnitude on the influence of predicted results. It is concluded that CFD can make the following contributions to the task of correlating wind tunnel and flight test data: some effects of geometry differences and aeroelastic distortion can be predicted, tunnel wall effects can be assessed and corrected for, and the effects of model support systems and free stream nonuniformities can be modeled. TM

N82-25214*# National Aeronautics and Space Administration
Langley Research Center Hampton, Va
ELASTIC DEFORMATION EFFECTS ON AERODYNAMIC CHARACTERISTICS FOR A HIGH-ASPECT-RATIO SUPERCRITICAL-WING MODEL

Judith J Watson May 1982 26 p refs
(NASA-TM-83286, L-15098, NAS 115 83286) Avail NTIS HC A03/MF A01 CSCL 01A

The results of an investigation of the deformations of a high-aspect-ratio, force/pressure supercritical-wing model during wind tunnel tests and the effects these deformations have on the wing aerodynamics are presented. A finite element model of the wing was developed and then, for conditions corresponding to wind tunnel test points, experimental aerodynamic loads and theoretical aerodynamic loads were applied to the finite element model. Comparisons were made between the results of these load conditions for changes in structural deflections and for changes in aerodynamic characteristics. The results show that the deformations are quite small and that the pressure data are not significantly affected by model deformation. BW

N82-25215*# Northrop Corp., Hawthorne, Calif, Aircraft Div
WATER TUNNEL FLOW VISUALIZATION AND WIND TUNNEL DATA ANALYSIS OF THE F/A-18

Gary E Erickson May 1982 268 p refs. Original contains color illustrations. 2 Vol.
(Contract NAS1-16617)
(NASA-CR-165859, NAS 126 165859) Avail NTIS HC A12/MF A01 CSCL 01A

Six degree of freedom studies were utilized to extract a band of yawing and rolling moment coefficients from the F/A-18 aircraft flight records. These were compared with 0.06 scale model data obtained in a 16T wind tunnel facility. The results indicate the flight test yawing moment data exhibit an improvement over the wind tunnel data to near neutral stability and a significant reduction in lateral stability (again to near neutral level). These data are consistent with the flight test results since the motion was characterized by a relatively slow departure. Flight

tests repeated the slow yaw departure at M 0.3 Only 0.16 scale model wind tunnel data showed levels of lateral stability similar to the flight test results. Accordingly, geometric modifications were investigated on the 0.16 scale model in the 30x60 foot wind tunnel to improve high angle of attack lateral stability. S L

N82-25216*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
SUBSONIC AERODYNAMIC AND FLUTTER CHARACTERISTICS OF SEVERAL WINGS CALCULATED BY THE SOUSSA P11 PANEL METHOD

E Carson Yates, Jr. Herbert J. Cunningham, Robert N. Desmarais, Walter A. Silva and Bohdan Drobenko. May 1982. 21 p. refs. Presented at the AIAA/ASME/ASCE/AHS 23rd Structures, Structural Dynamics and Materials Conf., New Orleans, 10-12 May 1982.
 (NASA-TM-84485, NAS 115 84485) Avail NTIS HC A02/MF A01 CSCL 01A

The SOUSSA (steady, oscillatory, and unsteady subsonic and supersonic aerodynamics) program is the computational implementation of a general potential flow analysis (by the Green's function method) that can generate pressure distributions on complete aircraft having arbitrary shapes, motions and deformations. Some applications of the initial release version of this program to several wings in steady and oscillatory motion, including flutter are presented. The results are validated by comparisons with other calculations and experiments. Experiences in using the program as well as some recent improvements are described. S L

N82-25217*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
EXPERIMENTAL DETERMINATION OF FLOW-INTERFERENCE EFFECTS OF WING-MOUNTED, TWO-DIMENSIONAL, FULL-CAPTURE PROPULSION NACELLES IN CLOSE PROXIMITY TO A VEHICLE BODY AT A MACH NUMBER OF 6

Walter A. Vahl. May 1982. 36 p. refs.
 (NASA-TM-83287, L-15209, NAS 115 83287) Avail NTIS HC A03/MF A01 CSCL 01A

Experimental tests have been conducted to determine possible aerodynamic interference effects due to the lateral positioning of two dimensional propulsion nacelles mounted on a wing surface in close proximity to a vehicle body. The tests were conducted at a Mach number of 6 and a Reynolds number 7 million per foot. The angle of attack range for force tests was -9 deg to 9 deg. The model configurations consisted of combinations of rectangular and trapezoidal cross section bodies with a wing swept 65 and a rectangular planform wing. A pair of two dimensional, flow through propulsion nacelles simulated full capture inlet operation. S L

N82-25218*# National Aeronautics and Space Administration Langley Research Center Hampton, Va
THRUST-INDUCED EFFECTS ON LOW-SPEED AERODYNAMICS OF FIGHTER AIRCRAFT

Daniel W. Banks, P. Frank Quinto, and John W. Paulson Jr. May 1982. 25 p. refs.
 (NASA-TM-83277, NAS 115 83277) Avail NTIS HC A02/MF A01 CSCL 01A

Results of NASA Langley has conducted wind-tunnel investigations of several fighter configurations conducted to determine the effects of both thrust vectoring and spanwise blowing are reviewed. A recent joint NASA/Grumman Aerospace Corporation/U.S. Air Force Wright Aeronautical Laboratory wind-tunnel investigation was conducted to examine the effects of spanwise blowing on the trailing-edge flap system. This application contrasts with the more familiar method of spanwise blowing near the wing leading edge. Another joint program among NASA/McDonnell Aircraft Company/U.S. Air Force Wright Aeronautical Laboratory investigated the effects of reverse thrust on the low-speed aerodynamics of an F-15 configuration. The F-15 model was fitted with a rotating van thrust reverser concept which could simulate both in-flight reversing for approach and landing or full reversing for ground roll reduction. The significant results of these two joint programs are reported. A R H

N82-25219*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
PRODUCTION VERSION OF THE EXTENDED NASA-LANGLEY VORTEX LATTICE FORTRAN COMPUTER PROGRAM. VOLUME 1 USER'S GUIDE

John E. Lamar and Henry E. Herbert. Apr 1982. 176 p. refs.
 (NASA-TM-83303, NAS 115 83303) Avail NTIS HC A08/MF A01 CSCL 01A

The latest production version, MARK IV, of the NASA-Langley vortex lattice computer program is summarized. All viable subcritical aerodynamic features of previous versions were retained. This version extends the previously documented program capabilities to four planforms, 400 panels and enables the user to obtain vortex-flow aerodynamics on cambered planforms, flowfield properties off the configuration in attached flow, and planform longitudinal load distributions. Author

N82-25220# Wisconsin Univ. - Madison. Mathematics Research Center
NONLINEAR TWO-DIMENSIONAL SAIL THEORY

Jean-Marc Vanden-Broeck. Oct 1981. 20 p. refs.
 (Contract DAAG29-80-C-0041, Grant NSF MCS-79-27062) (AD-A110450, MRC-TSR-2293) Avail NTIS HC A02/MF A01 CSCL 01/3

Steady two-dimensional flow past a sail is considered. The sail is assumed to be supported by two masts. The flow and the shape of the sail are determined as functions of the direction α of the flow at infinity and the Weber number λ . The full nonlinear problem is formulated as an integro-differential equation for the shape of the sail. This equation is discretized and solved numerically by Newton's method. Sail profiles, the slack in the sail, and the lift coefficient are presented for various values of α and λ . GRA

N82-25221# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics
ON THE AERODYNAMICS OF WINDBLAST. Final Technical Report

Daniel J. Schneck. 13 Nov 1981. 51 p. refs.
 (Grant AF-AFOSR-3706-78) (AD-A110495, VPI-E-81-31, AFOSR-82-0031TR) Avail NTIS HC A04/MF A01 CSCL 20/4

In two previous reports (Schneck, 1976, 1979) a mathematical theory was developed in order to calculate the aerodynamic loading to which a pilot is exposed during high speed ejections. Neglecting the effects of flow separation, preliminary results suggested that the pilot's musculo-skeletal resistance is not likely to withstand the tendency for dislodgement from a restraining surface if he is ejecting at Mach numbers exceeding 0.72. Recently (Schneck, 1979) the mathematical theory of windblast was modified to include some effects of flow separation. In the report that follows, these effects are examined in greater detail, particularly as they affect the time-course of limb dislodging forces after the onset of windblast. GRA

N82-25223# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering
EXPERIMENTAL ANALYSIS OF THE EFFECTS OF SWEEP AND ASPECT RATIO ON INCOMPRESSIBLE FLOW ABOUT FORWARD SWEEP WINGS. M.S. Thesis

Paul W. Savage. Dec 1981. 142 p. refs.
 (AD-A111128, AFIT/GAE/AA/81D-26) Avail NTIS HC A07/MF A01 CSCL 01/3

Low speed wind tunnel tests were conducted on nine wing planforms to determine the effect of sweep and aspect ratio on forward swept wings in incompressible flow. Sweep angles tested were -15, -30 and -45 degrees. Aspect ratios ranged from 2.05 to 4.79. A NACA 0006 airfoil section perpendicular to the leading edge was used for all models. Results showed increasing negative sweep decreased lift curve slope and shifted the aerodynamic center rearward. Increasing aspect ratio increased lift curve slope, decreased drag coefficient and shifted the aerodynamic center rearward. The wind tunnel aerodynamic data were compared to the Air Force Flight Dynamics Laboratory's Large Aircraft Performance Prediction Program to determine the program's ability to predict forward swept wing aerodynamic coefficients. At incompressible Mach numbers, the program was found to be accurate in predicting lift curve slope in the linear range using a positive sweep input. Drag Polar slope and moment coefficient were accurately predicted for lift coefficients below 0.4 using a negative sweep angle input. Neither positive nor negative angle input predicted maximum lift coefficient accurately. Author (GRA)

N82-25225# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering

INVESTIGATION OF UPWIND SCHEMES FOR FINITE ELEMENT ANALYSIS OF TRANSONIC FLOW OVER THIN AIRFOILS M S. Thesis

Dennis L Hunt Dec 1981 93 p refs
(AD-A111168 AFIT/GAE/AA/81D-15) Avail NTIS
HC A05/MF A01 CSCL 20/4

Two finite element upwind techniques were investigated to see if convergent solutions could be obtained from the transonic potential equation for steady flow over thin airfoils. The first technique involves the use of parabolic upwind functions, that when added to the shape functions weight the upstream node in the supersonic region more than the downwind nodes. The second technique integrates the finite element equations over the area that influences the solution (i.e. the area inside a mach cone).
Author (GRA)

N82-25226# Air Force Inst of Tech, Wright-Patterson AFB Ohio School of Engineering

STARTING TRANSIENTS IN SUPERSONIC NOZZLES AND NOZZLE-DIFFUSER ASSEMBLIES M S. Thesis

Thomas Gregory Gates Dec 1981 47 p refs
(AD-A111143 AFIT/GA/AA/81D-6) Avail NTIS
HC A03/MF A01 CSCL 20/4

In this investigation the flow processes involved in shock induced starting of nozzles and diffusers similar to those used in gasdynamic lasers were studied. Two geometrically similar nozzles were used. The throat opening in the large single nozzle was 0.276 inches. The other was an array of nine nozzle passages in which the throat opening was 0.069 inches. Downstream of the nine nozzles were nine diffusers whose minimum opening was 0.286 inches. These 2-dimensional nozzles and diffusers were 0.75 inches thick. A fully started condition of uniform supersonic flow was achieved throughout the entire test area for both test sections. The processes leading to this condition were highly dynamic and complicated. It was found that successful starting depended not only on the initial diaphragm pressure ratio, but also the downstream test cell configuration. Starting the large single nozzle was enhanced by an increase of flow channel just downstream from the nozzle. This decreased the strength of the incident shock wave and thereby increased the pressure ratio applied across the nozzle. As a result, the gasdynamic starting shock could pass on out of the nozzle at lower shock tube diaphragm pressure ratios than would have been the case if the area had remained constant in the flow channel behind the nozzle.
GRA

N82-25230# Aeronautical Research Inst of Sweden Stockholm Aerodynamics Dept

THE FFA WING BODY 81 COMPUTER PROGRAM A PANEL METHOD FOR DETERMINATION OF AERODYNAMIC CHARACTERISTICS AT SUBSONIC AND SUPERSONIC SPEEDS

Sven G Hedman and Lars G Tysell 1982 36 p refs
(Contract FMV-F-INK-82223-78-170-21-001)
(FFA-TN-AU-1601) Avail NTIS HC A03/MF A01

A panel program is extended in order to account for unsymmetric configurations and flow fields symmetric, antisymmetric or unsymmetric to the vertical plane. Input instructions are given. The program calculates pressure distribution for completely specified geometries, wing camber for given load distributions, and wing camber for minimum drag with given values of lift and pitching moment. The body length is divided into intervals each with a distribution of sources or doublets of either constant or linearly varying intensity. The boundary condition is fulfilled on the body surface midway between the ends of an interval. Compressible velocities are obtained by the Goethert rule and alternatively for the wing by a semiempirical compressibility correction method, based on the nonlinear compressibility effects in the flow about two-dimensional and sheared wings. Comparison of results with known data shows that the program works best for subsonic load calculations, involving elastic airplanes.
Author (ESA)

N82-25231# National Aerospace Lab, Amsterdam (Netherlands) Informatics Div

MODIFIED VERSION OF LTRAN2. A CALCULATION METHOD FOR INVISCID TRANSONIC FLOW ABOUT THIN AIRFOILS IN MODERATELY SLOW UNSTEADY MOTION

J vanderVooren and G H Huizing 26 Jun 1980 54 p refs
(Contract NIVR-1814)
(NLR-TR-80059-U) Avail NTIS HC A04/MF A01

A method for strictly slow unsteady motions is modified by including extra unsteady terms in the boundary conditions. The unsteady transonic small perturbation equation and the airfoil, wake and far field boundary conditions are derived heuristically. A radiation condition on the far field boundary which accommodates outgoing disturbances only is presented. Analysis shows that the infinite physical domain surrounding the airfoil can not be mapped onto a finite computational domain. Numerical experiments on an airfoil oscillating in pitch at reduced frequencies 0.05 and 0.1 for a freestream Mach number = 0.85 and zero angle of attack show that radiation condition can reduce the computational domain and the number of grid points.
Author (ESA)

N82-25232# National Aerospace Lab Amsterdam (Netherlands) Informatics Div

COMPARISON OF BOUNDARY LAYER CALCULATIONS FOR THE ROOT SECTION OF A WING THE SEPTEMBER 1979 AMSTERDAM WORKSHOP TEST CASE

J P F Lindhout, B vandenBerg and A Elsenaar 6 Mar 1981 71 p refs
(NLR-MP-80028-U) Avail NTIS HC A04/MF A01

Integral and field method calculations of three-dimensional turbulent boundary layer development including separation on the root section of a swept wing are compared. Although the predicted position of the separation region varies, all methods give a good global impression of the state of the nonseparated part of the three-dimensional boundary layer. In the weakly three-dimensional region of the flow agreement between the results is very good. In the strongly three-dimensional region variation is considerable. Field methods vary more than integral methods. The integral methods are on average ten times faster than the field methods.
Author (ESA)

N82-25233# Messerschmitt-Boelkow-Blohm G m b H, Otto-brunn (West Germany) Unternehmensbereich Drehfluegler

THE PROBLEM OF CALCULATION OF THE FLOW AROUND HELICOPTER ROTOR BLADE TIPS

H Stahl 19 Aug 1981 22 p refs Presented at 7th European Rotorcraft and Powered Lift Aircraft Forum Garmisch-Partenkirchen West Germany 8-11 Sep 1981, sponsored by DGLR
(MBB-UD-330-81-0) Avail NTIS HC A02/MF A01

Computational problems that arise with the theoretical analysis of the flow around rotary wing blade tips are evoked. The modification of existing computer programs in order to handle three-dimensional, unsteady rotational flow that on the advancing blade in fast forward flight, can also be transonic is discussed. Potential flow theory is presented. A program for steady three-dimensional flow past a fixed wing was adapted for a rotating blade, taking into account the irrotational condition of the applied theory. Calculations show that this approach leads to an acceptable description of the actual flow.
Author (ESA)

N82-25234# Messerschmitt-Boelkow-Blohm G m b H Otto-brunn (West Germany) Unternehmensbereich Drehfluegler und Verkehr

PROGRAM PRESENTATION OF THE WORKING GROUP SEPARATED FLOW PROBLEMS WITH ROTARY WINGS [PROGRAM-PRAESENTATION DER ARBEITSGEMEINSCHAFT STROEMUNGEN MIT ABLOESUNGEN (STAB) THEMENKREIS DREHFLUEGEL]

G Polz 19 Mar 1981 19 p In GERMAN
(MBB-UD-336-81-0) Avail NTIS HC A02/MF A01

With reference to propellers and rotors relevant separation phenomena and their resulting effects are described. These include stress induced separation at the blade tip associated with high Mach numbers, separation due to exceeding maximum lift for low Mach numbers, and vortex induced separation. Cause/effect relationships with advancing blade tip vortices are emphasized. All of these separation phenomena have a negative influence on performance and economy in flight management. As for helicopter rotors, the identified extremely high dynamic flight loads can cause acute structural loading and vibration. Minimization of flow separation and its effects is possible by improving blade profiles, optimizing blade shapes (planform/warpage) and by developing blade tips.
Author (ESA)

N82-25235*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

EVALUATION OF A VOICE RECOGNITION SYSTEM FOR

THE MOTAS PSEUDO PILOT STATION FUNCTION

Jacob A Houck Apr 1982 57 p refs
(NASA-TM-84487, NAS 115 84487) Avail NTIS
HC A04/MF A01 CSCL 17G

The Langley Research Center has undertaken a technology development activity to provide a capability, the mission oriented terminal area simulation (MOTAS) wherein terminal area and aircraft systems studies can be performed. An experiment was conducted to evaluate state-of-the-art voice recognition technology and specifically the Threshold 600 voice recognition system to serve as an aircraft control input device for the MOTAS pseudo pilot station function. The results of the experiment using ten subjects showed a recognition error of 3.67 percent for a 48-word vocabulary tested against a programmed vocabulary of 103 words. After the ten subjects retrained the Threshold 600 system for the words which were misrecognized or rejected, the recognition error decreased to 1.96 percent. The rejection rates for both cases were less than 0.70 percent. Based on the results of the experiment, voice recognition technology and specifically the Threshold 600 voice recognition system were chosen to fulfill this MOTAS function. Author

N82-25236* Bolt, Beranek, and Newman, Inc., Cambridge Mass

AN AIRCRAFT SENSOR FAULT TOLERANT SYSTEM Interim Report

Alper K Caglayan and Roy E Lancraft Apr 1982 113 p refs

(Contract NAS1-16579)

(NASA-CR-165876, NAS 126 165876, BBN-4858) Avail NTIS HC A06/MF A01 CSCL 17G

The design of a sensor fault tolerant system which uses analytical redundancy for the Terminal Configured Vehicle (TCV) research aircraft in a Microwave Landing System (MLS) environment was studied. The fault tolerant system provides reliable estimates for aircraft position, velocity, and attitude in the presence of possible failures in navigation aid instruments and onboard sensors. The estimates, provided by the fault tolerant system, are used by the automated guidance and control system to land the aircraft along a prescribed path. Sensor failures are identified by utilizing the analytic relationship between the various sensor outputs arising from the aircraft equations of motion. E A K

N82-25239* Hampton Inst Va

[COST AND FUEL CONSUMPTION PER NAUTICAL MILE FOR TWO ENGINE JET TRANSPORTS USING OPTIM AND TRAGEN] Final Report

John F Wiggs 30 Apr 1982 280 p
(Grant NAG1-69)

(NASA-CR-168973, NAS 126 168973) Avail NTIS
HC A13/MF A01 CSCL 01C

The cost and fuel consumption per nautical mile for two engine jet transports are computed using OPTIM and TRAGEN. The savings in fuel and direct operating costs per nautical mile for each of the different types of optimal trajectories over a standard profile are shown. S L

N82-25240* National Aeronautics and Space Administration Langley Research Center, Hampton, Va

LEADING EDGE FLAP SYSTEM FOR AIRCRAFT CONTROL AUGMENTATION Patent Application

Dhanvada M Rao inventor (to NASA) (Old Dominion Univ) Filed 10 Sep 1981 15 p Sponsored by NASA
(NASA-Case-LAR-12787-1, US-Patent-Appl-SN-301078) Avail NTIS HC A02/MF A01 CSCL 01C

Traditional roll control systems such as ailerons, elevons or spoilers are least effective at high angles of attack due to boundary layer separation over the wing. Independently deployed leading edge flaps on the upper surfaces of vortex stabilized wings are used to shift the center of lift outboard. A rolling moment is created that is used to control roll in flight at high angles of attack. The effectiveness of the rolling moment increases linearly with angle of attack. No adverse yaw effects are induced. In an alternate mode of operation both leading edge flaps are deployed together at cruise speeds to create a very effective airbrake without appreciable modification in pitching moment. Little trim change is required. NASA

N82-25241* National Aeronautics and Space Administration, Washington D C

AERODYNAMICS/ACEE. AIRCRAFT ENERGY EF-**FICIENCY**

1981 8 p refs

(NASA-Facts-94/8-81) Avail NTIS HC A02/MF A01 CSCL 01C

An overview is presented of a 10 year program managed by NASA which seeks to make possible the most efficient use of energy for aircraft propulsion and lift as well as provide a technology that can be used by U S manufacturers of air transports and engines. Supercritical wings, winglets, vortex drag reduction, high lift, active control laminar flow control, and aerodynamics by computer are among the topics discussed. Wind tunnel models in flight verification of advanced technology, and the design, construction and testing of various aircraft structures are also described. A R H

N82-25242* National Aeronautics and Space Administration, Washington, D C

MATERIALS AND STRUCTURES/ACEE

1981 8 p

(NASA-Facts-117/8-81) Avail NTIS HC A02/MF A01 CSCL 01C

Light weight composites made from graphite fibers, glass or man made materials held in an epoxy matrix, and their application to airframe design are reviewed. The Aircraft Energy Efficiency program is discussed. Characteristics of composites acceptable risks, building parts and confidence and aeroelastic tailoring are considered. N W

N82-25243* Naval Air Development Center Warminster, Pa Aircraft and Crew Systems Technology Directorate

STATISTICAL REVIEW OF COUNTING ACCELEROMETER DATA FOR NAVY AND MARINE FLEET AIRCRAFT FROM 1 JANUARY 1962 TO 30 JUNE 1981 Semiannual Summary Report

Warren J Williams 1 Nov 1981 149 p

(AD-A110660, NADC-13920-2) Avail NTIS
HC A07/MF A01 CSCL 01/1

This is a semi-annual progress report, and it presents a specialized summary of the data in the counting accelerometer program. Statistics describing Navy and Marine aircraft cumulative g-count exceedances are calculated and tabulated. These tabulations are separated by calendar time and into four major categories of fleet experience: Navy Training, Navy Combat, Marine Training, and Marine Combat. These data show that the load rate distributions (counts at 1000 hours) for most models and most g-levels have a non-normal distribution. Within a model (A-7E, F-4N, etc) differences in the average load rates exist when data are separated by calendar time or mission category. Author (GRA)

N82-25244* San Antonio Air Logistics Center, Kelly AFB, Tex

OV-10A NOSE GEAR FORK DAMAGE ANALYSIS Final Report, Aug 1980 - Sep. 1981

Kenneth F Barnes and James L Haines Jan 1982 49 p refs

(AD-A111492, SA-ALC/MM-7588) Avail NTIS
HC A03/MF A01 CSCL 03/1

A limited Damage Tolerance Analysis (DTA) of the OV-10A nose gear fork was performed to determine the fracture characteristics at a location on the underside of the fork in a machined fillet radius just aft of the jack point. The analysis included determination of a landing load history, finite element stress analysis, stress spectrum development, stress intensity solution, crack growth analysis and residual strength calculations. Author (GRA)

N82-25245* Boeing Military Airplane Development, Seattle, Wash Advanced Airplane Branch

FIREPROOF BRAKE HYDRAULIC SYSTEM Final Report, Jun 1980 - Jun. 1981

S M Warren and J R Kilner Wright-Patterson AFB Ohio AFWAL Sep 1981 391 p refs

(Contract F33615-80-C-2026 AF Proj 3145)

(AD-A111319, AFWAL-TR-81-2080) Avail NTIS
HC A17/MF A01 CSCL 01/2

The feasibility of a fireproof two-fluid brake hydraulic system which utilizes nonflammable chlorotrifluoroethylene (CTFE) fluid in a dead ended brake hydraulic system mechanically isolated from the primary MIL-H-5606 hydraulic system was studied. Experimental brake system hardware was designed, built and laboratory tested. Results indicate that the fireproof two-fluid

N82-25248

brake hydraulic system concept is feasible and the basic operation, control characteristics and stability of the brake system are not affected by the two-fluid configuration. The increased density of the CTFE fluid does not cause the hydraulic system to respond slower resulting in longer aircraft stopping distances. However analysis indicates that the performance lost by changing to the CTFE fluid can be regained by increasing brake hydraulic line sizes and returning the antiskid control box. Author (GRA)

N82-25248# Arinc Research Corp., Annapolis, Md
IMPROVEMENT PROGRAM FOR THE C-141 NAVIGATION SELECTOR PANEL Final Engineering Report
Henry L Riser Jr Jan 1982 20 p
(Grant F09603-80-G-3338-0012)
(AD-A111469, Rept-2315-11-1-2635) Avail NTIS
HC A02/MF A01 CSCL 01/4

This report presents the results of an engineering study to improve the reliability and maintainability of the Navigation Selector Panel, Part Number 75-89181 NSN 6605-01-038-6849JH, used in all models of the C-141 aircraft. The work described in this document was performed for the U S Air Force and specifically for the Reliability Engineering Branch, Item Management Division MMIRCA-4, of Robins Air Force Base Georgia, 31098. Maintenance data covering one year were obtained and analyzed. The items most often replaced were the lighted push-button switches in the assembly caused by poor switch design. Changes were recommended. Author (GRA)

N82-25249# Arinc Research Corp., Annapolis, Md
ELECTRONIC WARFARE AVIONICS INTEGRATION SUPPORT FACILITY SUPPORT PROCESSOR Final Report
C J Manspeaker F M Stamps, and C W Strack Nov 1981 217 p refs
(Grant F09603-80-G-3338-0011)
(AD-A111641, Rept-2311-11-1-2568) Avail NTIS
HC A10/MF A01 CSCL 09/3

ARINC Research was tasked to perform a long-range study of the functional and system requirements of the Electronic Warfare Avionics Integration Support Facility (EWAISF) support processor. This document describes the results of the four phases of that effort: the definition of functional requirements for data processing equipment (ADPE) and Software, identification of alternative architectures to fulfill these requirements, and a cost benefit analysis of the alternatives. Also recommendations for implementing a preferred architecture and describes a means for updating the study are given. Author (GRA)

N82-25250# National Aeronautics and Space Administration
Lewis Research Center, Cleveland Ohio
STGSTK A COMPUTER CODE FOR PREDICTING MULTISTAGE AXIAL FLOW COMPRESSOR PERFORMANCE BY A MEANLINE STAGE STACKING METHOD
Ronald J Steinke May 1982 65 p refs
(NASA-TP-2020, E-551 NAS 1 60 2020) Avail NTIS
HC A04/MF A01 CSCL 21E

A FORTRAN computer code is presented for off-design performance prediction of axial-flow compressors. Stage and compressor performance is obtained by a stage-stacking method that uses representative velocity diagrams at rotor inlet and outlet meanline radii. The code has options for (1) direct user input or calculation of nondimensional stage characteristics, (2) adjustment of stage characteristics for off-design speed and blade setting angle, (3) adjustment of rotor deviation angle for off-design conditions, and (4) SI or U S customary units. Correlations from experimental data are used to model real flow conditions. Calculations are compared with experimental data. Author

N82-25251# National Aeronautics and Space Administration, Washington D C
PROPULSION/ACEE
1981 12 p
(NASA-Facts-93/8-81) Avail NTIS HC A02/MF A01 CSCL 21E

The research objectives of the NASA aircraft energy efficiency program are summarized. Engine component improvements for turbofan engines, diagnostics, the development of advanced turboprop engines and propeller noise analysis are discussed. M G

N82-25252# Pennsylvania State Univ., University Park Lab of Turbomachinery

THREE DIMENSIONAL MEAN VELOCITY AND TURBULENCE CHARACTERISTICS IN THE ANNULUS WALL REGION OF AN AXIAL FLOW COMPRESSOR ROTOR PASSAGE

R Davino and B Lakshminarayana May 1982 262 p refs
(Grant NSG-3212)
(NASA-CR-169003, NAS 1 26 169003 PSU/TURBO-82-2) Avail NTIS HC A12/MF A01 CSCL 21E

The experiment was performed using the rotating hot-wire technique within the rotor blade passage and the stationary hot-wire technique for the exitflow of the rotor blade passage. The measurements reveal the effect of rotation and subsequent flow interactions upon the rotor blade flowfield and wake development in the annulus-wall region. The flow near the rotor blade tips is found to be highly complex due to the interaction of the annulus-wall boundary layer, the blade boundary layers, the tip leakage flow and the secondary flow. Within the blade passage, this interaction results in an appreciable radial inward flow as well as a defect in the mainstream velocity near the mid-passage. Turbulence levels within this region are very high. This indicates a considerable extent of flow mixing due to the viscous flow interactions. The size and strength of this loss core is found to grow with axial distance from the blade trailing edge. The nature of the rotor blade exit-flow was dominated by the wake development. T M

N82-25253# Pennsylvania State Univ University Park Lab of Turbomachinery INVESTIGATION OF THE TIP CLEARANCE FLOW INSIDE AND AT THE EXIT OF A COMPRESSOR ROTOR PASSAGE

A Pandya and B Lakshminarayana May 1982 147 p refs
(Grant NSG-3212)
(NASA-CR-169004, NAS 1 26 169004 PSU/TURBO-82-3) Avail NTIS HC A07/MF A01 CSCL 21E

The nature of the tip clearance flow in a moderately loaded compressor rotor is studied. The measurements were taken inside the clearance between the annulus-wall casing and the rotor blade tip. These measurements were obtained using a stationary two-sensor hot-wire probe in combination with an ensemble averaging technique. The flowfield was surveyed at various radial locations and at ten axial locations, four of which were inside the blade passage in the clearance region and the remaining six outside the passage. Variations of the mean flow properties in the tangential and the radial directions at various axial locations were derived from the data. Variation of the leakage velocity at different axial stations and the annulus-wall boundary layer profiles from passage-averaged mean velocities were also estimated. B W

N82-25254# General Electric Co., Evendale, Ohio Materials and Processes Technology Labs COST/BENEFIT STUDIES OF ADVANCED MATERIALS TECHNOLOGIES FOR FUTURE AIRCRAFT TURBINE ENGINES MATERIALS FOR ADVANCED TURBINE ENGINES

M Stearns and L Wilbers May 1982 49 p
(Contract NAS3-20074)
(NASA-CR-167849, NAS 1 26 167849) Avail NTIS
HC A03/MF A01 CSCL 21E

Cost benefit studies were conducted on six advanced materials and processes technologies applicable to commercial engines planned for production in the 1985 to 1990 time frame. These technologies consisted of thermal barrier coatings for combustor and high pressure turbine airfoils, directionally solidified eutectic high pressure turbine blades (both cast and fabricated), and mixers, tail cones, and piping made of titanium-aluminum alloys. A fabricated titanium fan blisk, an advanced turbine disk alloy with improved low cycle fatigue life, and a long-life high pressure turbine blade abrasive tip and ceramic shroud system were also analyzed. Technologies showing considerable promise as to benefits: low development costs, and high probability of success were thermal barrier coating, directionally solidified eutectic turbine blades, and abrasive-tip blades/ceramic-shroud turbine systems. R J F

N82-25255# National Aeronautics and Space Administration
Lewis Research Center, Cleveland Ohio
EXHAUST EMISSIONS SURVEY OF A TURBOFAN ENGINE FOR FLAME HOLDER SWIRL TYPE AUGMENTORS AT SIMULATED ALTITUDE FLIGHT CONDITIONS
John E Moss, Jr Oct 1981 47 p refs

(NASA-TM-82787, E-955 NAS 115 82787) Avail NTIS HC A03/MF A01 CSCL 21E

Emissions of carbon dioxide total oxides of nitrogen unburned hydrocarbons and carbon monoxide from an F100 afterburning two spool turbofan engine at simulated flight conditions are reported Tests were run at Mach 0.8 at altitudes of 10 97 and 13 71 km (36 000 and 45 000 ft) and at Mach 1.2 at 13 71 km (45 000 ft) Emission measurements were made from intermediate power (nonafterburning) through maximum afterburning using a single point gas sample probe traversed across the horizontal diameter of the exhaust nozzle The data show that emissions vary with flight speed altitude, power level, and radial position across the nozzle Carbon monoxide emissions were low for intermediate and partial afterburning power Unburned hydrocarbons were near zero for most of the simulated flight conditions At maximum afterburning, there were regions of NOx deficiency in regions of high CO The results suggest that the low NOx levels observed in the tests are a result of interaction with high CO in the thermal converter CO2 emissions were proportional to local fuel air ratio for all test conditions

T M

N82-25256*# Georgia Inst of Tech Atlanta School of Aerospace Engineering
DEVELOPMENT OF AN ANALYTICAL TECHNIQUE FOR THE OPTIMIZATION OF JET ENGINE AND DUCT ACOUSTIC LINERS Final Technical Report, 1 Mar 1981 - 28 Feb 1982

Ben T Zinn and William L Meyer 28 Feb 1982 159 p refs (Grant NAG1-133)
(NASA-CR-169002 NAS 126 169002) Avail NTIS HC A08/MF A01 CSCL 21E

A new method was developed for the calculation of optimum constant admittance solutions for the minimization of the sound radiated from an arbitrary axisymmetric body This method utilizes both the integral equation technique used in the calculation of the optimum non-constant admittance liners and the independent solution generated as a by product of these calculations The results generated by both these methods are presented for three duct geometries (1) a straight duct (2) the QCSEE inlet and (3) the QCSEE inlet less its centerbody Author

N82-25257*# United Technologies Corp East Hartford Conn Commercial Products Div

FRACTURE MECHANICS CRITERIA FOR TURBINE ENGINE HOT SECTION COMPONENTS Final Report

G J Meyers May 1982 123 p refs
(Contract NAS3-22550)
(NASA-CR-167896 NAS 126 167896 PWA-5772-23) Avail NTIS HC A06/MF A01 CSCL 21E

The application of several fracture mechanics data correlation parameters to predicting the crack propagation life of turbine engine hot section components was evaluated An engine survey was conducted to determine the locations where conventional fracture mechanics approaches may not be adequate to characterize cracking behavior Both linear and nonlinear fracture mechanics analyses of a cracked annular combustor liner configuration were performed Isothermal and variable temperature crack propagation tests were performed on Hastelloy X combustor liner material The crack growth data was reduced using the stress intensity factor the strain intensity factor the J integral, crack opening displacement, and Tomkins' model The parameter which showed the most effectiveness in correlation high temperature and variable temperature Hastelloy X crack growth data was crack opening displacement S L

N82-25259# Air Force Wright Aeronautical Labs Wright-Patterson AFB, Ohio Ramjet Technology Branch

COAXIAL DUMP RAMJET COMBUSTOR COMBUSTION INSTABILITIES PART 1 PARAMETRIC TEST DATA Interim Report, Feb 1979 - Mar 1980

D L Davis Jul 1981 333 p refs 2 Vol
(AF Proj 2308)
(AD-A111355 AFWAL-TR-81-2047-Pt-1) Avail NTIS HC A15/MF A01 CSCL 21/5

This report contains Combustion Instability Data for Coaxial Dump Ramjet Combustors The data includes pressure vs time RMS pressure spectrums, peak and broadband RMS pressures, and related steady state performance data Analysis and interpretation of the data are reserved for future reports Also included is a description of RMS pressure and its relation to wave shape Author (GRA)

N82-25260# Messerschmitt-Boelkow-Blohm G m b H Otto-brunn (West Germany) Unternehmensbereich Raumfahrt
NEW DEVELOPMENTS IN THE FIELD OF RAMJET MISSILE PROPULSION (NEUE ENTWICKLUNGEN AUF DEM GEBIET DER FLUGKOERPER-STAUANTRIEBE)

H-L Weinreich 12 Nov 1981 65 p refs In GERMAN
(MBB-UR-516-81-0) Avail NTIS HC A04/MF A01

Various supersonic ramjets are discussed which were proposed for the propulsion systems of tactical missiles with higher average velocities Design and general operating characteristics of ramjet engines are reviewed The interaction between intake system and ramjet combustion chamber performance is treated with reference to throttling schemes Ramjet engines, using liquid or solid propellant, as well as solid fuel ramrockets are studied Experimentally proven performance of ramjet designs is cited and technological trends are identified Development results concern fuel inlet systems, variable thrust chokes and ramjet combustion chamber/integral booster configurations

Author (ESA)

N82-25261*# National Aeronautics and Space Administration Washington D C

GUIDANCE AND CONTROL/ACEE

1981 8 p

(NASA-Facts-95/8-81) Avail NTIS HC A02/MF A01 CSCL 01C

Active controls improve airplane performance by stabilizing its flight, reducing departures from stable flight, and alleviating loads imposed by external forces such as gusts turbulence or maneuvers Some uses for active control systems, the design of redundant and reliable stability augmentation systems digital fly-by-wire and NASA assessments of the technology of sensors and actuators are discussed A series of trade-off studies to better define optimum flight control systems and research by drone and full-scale models are described A R H

N82-25262*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

BARRIERS AND DISPERSAL SURFACES IN MINIMUM-TIME INTERCEPTION

N Rajan and M D Ardema May 1982 34 p refs
(NASA-TM-84241, A-8912, NAS 115 84241) Avail NTIS HC A03/MF A01 CSCL 01C

Minimum time interception of a target moving in a horizontal plane is analyzed as a one-player differential game Dispersal points and points on the barrier are located for a class of pursuit evasion and interception problems These points are determined by constructing cross sections of the isochrones and hence obtaining the barrier dispersal and control level surfaces The game solution maps the controls as a function of the state within the capture region J D

N82-25263# Washington Univ St Louis Mo Dept of Mechanical Engineering

OPTIMIZATION OF AUTO-PILOT EQUATIONS FOR RAPID ESTIMATION OF HELICOPTER CONTROL SETTINGS

Interim Technical Report, Jul 1980 - Nov. 1981

Han-Sheng Chen and David A Peters Nov 1981 29 p refs
(Contract DAAG29-80-C-0092)

(AD-A110739 ARO-17067 1-E, ITR-1) Avail NTIS HC A03/MF A01 CSCL 01/1

An automatic feedback system, based on continuous monitoring of control loads is used to find the control settings that are required to obtain a given flight condition of a helicopter rotor A program is developed that searches automatically for the optimum gains and time constants of the system Satisfactory results are achieved to given conditions as an example

Author (GRA)

N82-25264# Air Force Inst of Tech Wright-Patterson AFB, Ohio School of Engineering

USE OF THE PSEUDO-INVERSE FOR DESIGN OF A RECONFIGURABLE FLIGHT CONTROL SYSTEM M S Thesis

Syed Javed Raza Dec 1981 156 p refs
(AD-A111172 AFIT/GAE/AA/81D-23) Avail NTIS HC A08/MF A01 CSCL 01/3

Reconfiguration of the flight control system is achieved using generic inputs and transformation matrices for single primary control surface failure Pseudo-inverse is used to evaluate appropriate transformation matrices Design is tested against non-linear six degree-of-freedom model of the A-7D by simulating

failure flights System was found to provide desirable flying qualities upon reconfiguration Author (GRA)

N82-25265# National Aerospace Lab Amsterdam (Netherlands) Flight Div

ROLL RESPONSE CRITERIA FOR TRANSPORT AIRCRAFT WITH ADVANCED FLIGHT CONTROL SYSTEMS IN THE LANDING APPROACH AND TOUCHDOWN

M F C vanGool 26 Oct 1980 134 p refs
(Contracts NIVR-1745, RB-RLD/78017, RB-RLD/78017/1 RB-RLD/79036)
(NLR-TR-80103-U) Avail NTIS HC A07/MF A01

Approach and landing of an aircraft equipped with a roll-rate-command/bank-angle-hold flight control system were investigated, using a moving base simulator Pilot comments and ratings following systematic variation of roll mode time constant maximum available roll rate, and pure time delay were noted Results indicate that roll response criteria are too lenient The more precise control of bank angle, available with the flight control system, leads to a higher internal standard of the pilot for his judgement of roll response quality These control systems must comply with more strict requirements than conventional systems to obtain the same degree of pilot approval Based on the experiments, limits/boundaries in existing criteria are redefined and criteria are proposed Author (ESA)

N82-25266# Boeing Military Airplane Development, Wichita, Kans

CONCEPTUAL DESIGN STUDY FOR AN ADVANCED CAB AND VISUAL SYSTEM, VOLUME 1 Final Report

R J Rue, M L Cyrus T A Garnett J W Nachbor, J A Seery and R L Starr Jul 1980 116 p refs Sponsored in part by the Dept of the Army 2 Vol
(Contract NAS2-10464)
(NASA-CR-166235, NAS 1 26 166235) Avail NTIS HC A06/MF A01 CSCL 14B

A conceptual design study was conducted to define requirements for an advanced cab and visual system The rotorcraft system integration simulator is for engineering studies in the area of mission associated vehicle handling qualities Principally a technology survey and assessment of existing and proposed simulator visual display systems, image generation systems, modular cab designs, and simulator control station designs were performed and are discussed State of the art survey data were used to synthesize a set of preliminary visual display system concepts of which five candidate display configurations were selected for further evaluation Basic display concepts incorporated in these configurations included real image projection using either periscopes, fiber optic bundles, or scanned laser optics and virtual imaging with helmet mounted displays These display concepts were integrated in the study with a simulator cab concept employing a modular base for aircraft controls, crew seating, and instrumentation (or other) displays A simple concept to induce vibration in the various modules was developed and is described Results of evaluations and trade offs related to the candidate system concepts are given, along with a suggested weighting scheme for numerically comparing visual system performance characteristics S L

N82-25267# Boeing Military Airplane Development, Wichita, Kans

CONCEPTUAL DESIGN STUDY FOR AN ADVANCED CAB AND VISUAL SYSTEM, VOLUME 2 Final Report

R J Rue M L Cyrus, T A Garnett, J W Nachbor, J A Seery, and R L Starr Jul 1980 171 p refs Sponsored in part by the Dept of the Army 2 Vol
(Contract NAS2-10464)
(NASA-CR-166236, NAS 1 26 166236) Avail NTIS HC A08/MF A01 CSCL 14B

The performance design, construction and testing requirements are defined for developing an advanced cab and visual system The rotorcraft system integration simulator is composed of the advanced cab and visual system and the rotorcraft system motion generator, and is part of an existing simulation facility Users applications for the simulator include rotorcraft design development, product improvement, threat assessment, and accident investigation S L

N82-25270# Air Force Human Resources Lab, Brooks AFB, Tex Operations Training Div
SIMULATOR FOR AIR-TO-AIR COMBAT VERSUS REAL

WORLD VISUAL CUE ANALYSIS FOR SIMULATED AIR-TO-AIR COMBAT TRAINING Final Report

Robert E Coward and Alexander M Rupp Jan 1982 26 p refs

(AF Proj 1123)
(AD-A110570, AFHRL-TR-81-26) Avail NTIS HC A03/MF A01 CSCL 05/9

Flying an aircraft requires a continuous interpretation of the visual environment in which the pilot uses visual information from outside the cockpit and from the flight instruments inside the cockpit to develop and maintain an awareness of the status of the aircraft and its location in space Flying a high-speed/high-performance aircraft in an air-to-air combat environment vastly increases the complexity of the pilot's task The pilot must also keep track of and evaluate the performance of any opposing aircraft To maintain a dynamic awareness of the situation and ultimately to be successful in the airborne arena the pilot depends heavily on interpretation of out-of-the-cockpit visual cues Usually training of the necessary visual skills for air-to-air combat takes place entirely in the aircraft - a high stress environment where the student pilot quickly can become overwhelmed with visual information In addition, the training is severely limited by both rules of engagement and aircraft safety limitations that prevent the student pilot from experiencing and practicing maximum performance tactics GRA

N82-25271# Committee on Science and Technology (U S House)

THE FIRST A IN NASA

Washington GPO 1982 194 p Hearings before the Subcomm on Transportation, Aviation and Mater of the Comm on Sci and Technol, 97th Congr, 1st Sess, No 61 8 Dec 1981
(GPO-89-476) Avail Subcommittee on Transportation, Aviation and Materials

The contributions of NACA/NASA to both civil and military aviation are reviewed and the current relations of NASA with the aircraft industry and academia are examined in the light of proposed cuts in the aeronautics technology research portion of the agency's budget The impact of the closing of the Lewis Research Center on the development of military aircraft is considered A R H

N82-25334# Messerschmitt-Boelkow-Blohm G m b H, Otto-brunn (West Germany) Unternehmensbereich Drehfluegler
CALCULATION OF THE CROSS SECTION PROPERTIES AND THE SHEAR STRESSES OF COMPOSITE ROTOR BLADES

Rudolf Woerndle 8 Sep 1981 32 p refs Presented at 7th European Rotorcraft and Powered Lift Aircraft Forum, Garmisch-Partenkirchen, West Germany, 8-11 Sep 1981 sponsored by DGLR
(MBB-UD-334-81-0) Avail NTIS HC A03/MF A01

Shear stress distribution and shear stiffness of transversely loaded cylindrical beams of any cross sectional shape are determined, using the finite element method Warp, resulting from transverse load is calculated with special two dimensional elements If the warping of any cross section is known, shear stress distribution, shear stiffness, and shear center can be found These values are obtained for any cross section through two dimensional analysis and therefore, the whole structure must be considered Stress distribution calculation results for complicated cross sections, i e for material that is homogeneous or inhomogeneous, isotropic or orthotropic are shown Because only small amounts of computational effort are necessary, the method is appropriate to the early design state However, the validity of the theory is limited to small conus angles Author (ESA)

N82-25383# Messerschmitt-Boelkow-Blohm G m b H, Otto-brunn (West Germany) Betriebsbereich

MECHANICAL PROPERTIES OF HOT ISOSTATIC PRESSED P/M-TITANIUM FOR HELICOPTER COMPONENTS

Wolfgang Keinath and Marko Tapavicza 1981 31 p refs Presented at 7th European Rotorcraft and Powered Lift Aircraft Forum, Garmisch-Partenkirchen, West Germany, 8-11 Sep 1981, sponsored by DGLR
(MBB-UD-324-81-0) Avail NTIS HC A03/MF A01

The production of titanium alloy (Ti6Al4V) aircraft components was investigated Powder metallurgy (P/M) manufacturing processes that involve hot isostatic pressing (HIP) and investment casting were characterized The microstructure of P/M HIP Ti6Al4V bar and plate specimens is depicted Mechanical properties were determined by static tensile and fatigue testing

and a modified Goodman diagram was derived Mechanical properties are the same as those of the corresponding wrought alloy Static and dynamic values for a P/M HIP Ti6Al4V blade fitting were also found from results of helicopter rotor hub component tests Analysis shows that the blade fitting fulfills strength requirements Reduction in machining as well as raw material weight savings when manufacturing P/M HIP components are pointed out
Author (ESA)

N82-25399# General Technology Applications, Inc., Arlington, Va

INVESTIGATION OF THE APPLICATION OF A CRYOGENIC BLENDING PROCESS TO PRODUCE ANTIMISTING DIESEL FUELS Final Report

Albert F Hadermann, Paul Waters, Jerry C Trippe, and William Weitzen 15 Jan 1982 65 p refs
(Contract DAAK70-81-C-0134)
(AD-A110917, GTA-A-001) Avail NTIS HC A04/MF A01 CSCL 21/4

Fire-resistant fuels have been investigated by the United States Army as a means of reducing the risk of fire in land combat vehicles and certain aircraft One approach has been the use of high-molecular-weight polymer additives for suppression of mist formations The polymers which are effective in mist suppression are very difficult to dissolve in fuel A newly discovered process for dissolving high-molecular-weight polymers is investigated to determine its applicability to the preparation of mist suppression fuels The conclusions area that certain high-molecular-weight polymers which show strong mist suppression behavior can be dissolved rapidly in diesel fuel and that the new dissolving process appears to be adaptable to field use

Author (GRA)

N82-25402# Naval Research Lab, Washington, D C
EVALUATION OF THREE PERCENT AQUEOUS FILM FORMING FOAM (AFFF) CONCENTRATES AS FIRE FIGHTING AGENTS Final Report, Sep 1978 - Nov. 1980

Edwin J Jablonski Tyndall AFB, Fla Air Force Engineering and Services Center Apr 1981 45 p refs
(AF Proj 2505)

(AD-A110821, AFESC/ESL-TR-81-18) Avail NTIS HC A03/MF A01 CSCL 13/12

A large-scale fire test program involving 20,000-square foot JP-4 fuel fires was conducted to evaluate the fire suppression effectiveness and compatibility of 3 percent Aqueous Film Forming Foam (AFFF) agents in Air Force fire fighting vehicles Three commercially available 3 percent AFFF concentrates were tested in accordance with military specification MIL-F-24385B Test results are summarized in Appendix A As a result of these tests, an updated Revision C to this MIL SPEC has been accomplished with new requirements for both 3 percent and 6 percent AFFF extinguishing agents
Author (GRA)

N82-25404# Lockheed Missiles and Space Co., Palo Alto, Calif
PANEL OPTIMIZATION WITH INTEGRATED SOFTWARE (POIS). VOLUME 1. PANDA. INTERACTIVE PROGRAM FOR PRELIMINARY MINIMUM WEIGHT DESIGN Final Report, Jun. 1976 - Oct. 1980

David Bushnell Wright-Patterson AFB, Ohio AFWAL Jul 1981 262 p refs

(Contract F33615-76-C-3105, AF Proj 2307)
(AD-A110963, AFWAL-TR-81-3073-Vol-1) Avail NTIS HC A12/MF A01 CSCL 01/3

An analysis and an interactive computer program are described through which minimum weight designs of composite, stiffened, cylindrical panels can be obtained subject to general and local buckling constraints and stress and strain constraints The panels are subjected to arbitrary combinations of in-plane axial, circumferential, and shear resultants Nonlinear material effects are included if the material is isotropic or has stiffness in only one direction (as does a discrete or a smeared stiffener) Several types of general and local buckling modes are included as constraints in the optimization process, including general instability, panel instability with either stringers or rings smeared out, local skin buckling, local crippling of stiffener segments, and general, panel, and local skin buckling including the effects of stiffener rolling Certain stiffener rolling modes in which the panel skin does not deform but the cross section of the stiffener does deform are also accounted for The interactive PANDA system consists of three independently executed modules that share the same data base In the first module an initial design

concept with rough (not necessarily feasible or accurate) dimensions are provided by the user in a conversational mode In the second module the user decides which of the design parameters of the concept are to be treated by PANDA as decision variables in the optimization phase In the third module the optimization calculations are carried out Many examples are provided in which optimum designs obtained by PANDA are compared to those in the literature
Author (GRA)

N82-25424# Rome Air Development Center, Griffiss AFB NY Strategic Surveillance Branch

RADAR FREQUENCY RADIATION Progress Report, Feb. 1978 - Sep 1981

Edward Malowicki Nov 1981 183 p ref
(AF Proj 2059)

(AD-A111852, RADC-TR-81-347) Avail NTIS HC A09/MF A01 CSCL 17/9

A method is presented for the determination of radar frequency radiation power densities that the PAVE PAWS radar system could produce in its air and ground environment The effort was prompted by the concern of the people in the vicinity of OTIS AFB MA and BEALE AFB CA about the possible radar frequency radiation hazard of the PAVE PAWS radar The method is based on the following main assumptions that (a) the total field can be computed as the vector summation of the individual fields due to each antenna element (b) the individual field can be calculated using distances for which the field point is in the far field of the antenna element An RFR computer program was coded for the RADC HE 6180 digital computer and exercised to calculate the radiation levels in the air and ground space for the present baseline and the possible Six DB and 10 DB growth systems of the PAVE PAWS radar system at OTIS AFB MA The average radiation levels due to the surveillance fence were computed for three regions in the air space in front of the radar, at the radar hazard fence at OTIS AFB MA and at representative ground points in the OTIS AFB vicinity It was concluded that the radar frequency radiation of PAVE PAWS does not present a hazard to personnel provided there is no entry to the air hazard zone or to the area within the hazard fence The method developed offers a cost effective way to determine radiation levels from a phased array radar especially in the near field and transition regions
GRA

N82-25435# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Systems and Logistics

A CASE STUDY OF RELIABILITY AND MAINTAINABILITY OF THE F-16 APG-66 FIRE CONTROL RADAR M S. Thesis

Daniel DeMarchi Sep 1981 115 p refs

(AD-A111387, AFIT-LSSR-99-81) Avail NTIS HC A06/MF A01 CSCL 17/9

During the development and test phase of weapon system acquisition, program management and design emphasis must be directed to producing a system that achieves reliability and maintainability in the field Investigated were these development and test efforts and test efforts and the demonstrated operational performance of a major weapon subsystem in the form of a case study analysis of the F-16 fire control radar Comparisons of predicted, test-demonstrated and operational APG-66 reliability and maintainability parameters constitute the significant portion of the analyses In addition, the reliability and maintainability programs and selected performance indicators of the APG-66 and APQ-120 are compared in order to examine the results of differing test-program acquisition policies This thesis effort determined that the APG-66 has not yet attained a constant failure rate indicative of an equipment's useful life The research also determined that increased efforts in the test function of an acquisition produces significant benefits in operational results A summary analysis of the entire program found the predictions based upon the critical design review and intermediate level maintainability demonstration to be somewhat optimistic
GRA

N82-25488# Perkin-Elmer Corp Pomona, Calif Aerospace Div

TECHNIQUES SUITABLE FOR A PORTABLE WEAR METAL ANALYZER Final Report, Oct 1980 - Apr 1981

William H Niu Eric B Andersen, and Gordon J Fergusson Wright-Patterson AFB, Ohio AFWAL Sep 1981 89 p refs
(Contract F33615-80-C-2037 AF Proj 3048)

(AD-A111352, AFWAL-TR-81-2076) Avail NTIS HC A05/MF A01 CSCL 20/8

A literature study for the techniques suitable for a portable wear metal analyzer has been conducted. The intent was to locate a technique which could lead to the development of a deployable field instrument to analyze metals in used aircraft engine oil for preventive maintenance purposes. Ten techniques, including six optical spectroscopic methods, two X-ray techniques, radioactive tagging and colorimetry, were evaluated. Emphasis was placed on the fundamental limitations of each technique for this particular application. As a result three optical techniques looked promising and their practicality was further investigated. The final assessment of these three techniques was based on the feasibility of making the instrument portable, low cost, able to analyze elements of interest particle size independent, and with moderate power consumption. The three techniques, in order of suitability are furnace atomic absorption spectroscopy, rotating disc electrode atomic emission spectroscopy, and dc plasma atomic emission spectroscopy. Author (GRA)

N82-25506# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering

HARDWARE AND SOFTWARE INTEGRATION FOR CONCURRENT DATA ACQUISITION AND REDUCTION OF PHOTON CORRELATED LASER DOPPLER VELOCIMETRY M.S. Thesis

David L Neyland Dec 1981 139 p refs
(AD-A111146, AFIT/GA/AA/81D-10) Avail NTIS
HC A07/MF A01 CSCL 14/2

A general Automatic Data Acquisition System dedicated to a broad range of experiments is used to operate the Digital Correlation signal processing equipment of a Laser Doppler Velocimeter, transfer data from the correlator into the Automatic Data Acquisition System computer and perform computations with the information. The Laser Doppler Velocimeter is used to acquire vast quantities of velocity and turbulence intensity information describing turbulent fluid flow about two dimensional airfoils. Integration of the velocimeter with the computer increases the capability of the system to perform large scale fluid dynamic studies. GRA

N82-25516# Illinois Univ., Chicago Dept of Materials Engineering

MATHEMATICAL MODELS FOR THE SYNTHESIS AND OPTIMIZATION OF SPIRAL BEVEL GEAR TOOTH SURFACES Final Report

F L Litvin, Pemez Rahman and Robert N Goldrich Jun 1982 122 p refs
(Grant NAG3-48)
(NASA-CR-3553, NAS 1 26 3553) Avail NTIS
HC A06/MF A01 CSCL 131

The geometry of spiral bevel gears and to their rational design are studied. The nonconjugate tooth surfaces of spiral bevel gears are, in theory, replaced (or approximated) by conjugated tooth surfaces. These surfaces can be generated by two conical surfaces, and by a conical surface and a revolution. Although these conjugated tooth surfaces are simpler than the actual ones, the determination of their principal curvatures and directions is still a complicated problem. Therefore, a new approach, to the solution of these is proposed. Direct relationships between the principal curvatures and directions of the tool surface and those of the generated gear surface are obtained. With the aid of these analytical tools, the Hertzian contact problem for conjugate tooth surfaces can be solved. These results are useful in determining compressive load capacity and surface fatigue life of spiral bevel gears. A general theory of kinematical errors exerted by manufacturing and assembly errors is developed. This theory is used to determine the analytical relationship between gear misalignments and kinematical errors. This is important to the study of noise and vibration in geared systems. S L

N82-25520# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio

LUBRICANT EFFECTS ON EFFICIENCY OF A HELICOPTER TRANSMISSION

Andrew M Mitchell and John J Coy 1982 16 p refs Presented at the AGARD Symp on Probl in Bearings and Lubrication, Ottawa, Canada, 31 May - 4 Jun 1982
(NASA-TM-82857 E-1226, NAS 1 15 82857, AVRADCOM-TR-82-C-9) Avail NTIS HC A02/MF A01 CSCL 01C

Eleven different lubricants were used in efficiency tests conducted on the OH-58A helicopter main transmission using

the NASA Lewis Research Center's 500 hp torque regenerative helicopter transmission test stand. Tests were run at oil-in temperatures of 355 K and 372 K. The efficiency was calculated from a heat balance on the water running through an oil to water heat exchanger which the transmission was heavily insulated. Results show an efficiency range from 98.3% to 98.8% which is a 50% variation relative to the losses associated with the maximum efficiency measured. For a given lubricant, the efficiency increased as temperature increased and viscosity decreased. There were two exceptions which could not be explained. Between lubricants, efficiency was not correlated with viscosity. There were relatively large variations in efficiency with the different lubricants whose viscosity generally fell in the 5 to 7 centistoke range. The lubricants had no significant effect on the vibration signature of the transmission. A R H

N82-25521# Pratt and Whitney Aircraft Group, West Palm Beach, Fla Government Products Div

CHEM-BRAZE ABRADABLE SEAL ATTACHMENT TO AIRCRAFT GAS TURBINE COMPRESSOR COMPONENTS Final Report, 1 Nov 1979 - 31 Sep 1980

Stephen T Narsavage, Saed Safai, and Harold W Pettit, Jr St Louis Army Aviation Research and Development Command Jan 1982 71 p
(Contract DAAG46-79-C-0102)
(AD-A111692, PWA-FR-13975, USAAVRADCOM-TR-82-F-2, AMMRC-TR-82-6) Avail NTIS HC A04/MF A01 CSCL 11/2

Manufacturing methods were established for bonding an abradable seal surface onto the stationary compressor element of small gas turbine engines utilizing an easily replaceable Chem-Braze bond system. Bonded specimens were prepared and evaluated in vibration and rub incursion tests. Tooling was fabricated for bonding a seal to Army supplied engine hardware and NDI methods were established for inspecting bond integrity. Chemical stripping techniques for removing Chem-Braze attached seals were optimized to permit efficient refurbishment of severely worn seals. An economic analysis indicated significant cost savings for attaching abradable seals to compressor blade tip shrouds using the improved Chem-Braze system compared to attachment with gold-nickel braze. The Chem-Braze system has been used successfully to bond abradable seals to titanium, cobalt, nickel and iron base alloys, however, attempts to use Chem-Braze to bond seals to selected aluminum and magnesium alloys were not successful. Author (GRA)

N82-25545# Lockheed Missiles and Space Co., Palo Alto Calif Applied Mechanics Lab

SUPPLEMENTARY STUDIES ON THE SENSITIVITY OF OPTIMIZED STRUCTURES Final Report, 14 Nov 1979 - 29 Sep 1980

Paul S Jensen and W A Loden Wright-Patterson AFB, Ohio AFWAL Mar 1981 81 p refs
(Contract F336150-76-C-3105, AF Proj 2307)
(AD-A110994, AFWAL-TR-81-3013) Avail NTIS
HC A05/MF A01 CSCL 13/13

Reports of three related studies germane to structural optimization are provided. The first describes virtual memory simulator suitable for management of large quantities of numerical data such as required for sparse matrix manipulation. The second report describes two sparse matrix processors suitable for the large equation systems arising in structural analysis and provides comparative results. The last report describes a study of two optimization algorithms in the context of structural optimization. A number of test results for parameter studies and a general comparison of the two algorithms are given. GRA

N82-25613# Measurement Concept Corp., Rome N Y

SOURCE ASSESSMENT SYSTEM Final Technical Report

Roy H Senn, M Lynn Taylor, Richard Burns, and Michael Smith Griffiss AFB, NY RADC Nov 1981 153 p refs
(Contract F30602-80-C-0040, AF Proj 4303)
(AD-A111223, RADC-TR-81-303) Avail NTIS
HC A08/MF A01 CSCL 09/2

This report contains an analysis of the Source Assessment Procedures at both Defense Mapping Agency (DMA) production facilities (Aerospace Center DMAAC in St Louis MO and Hydrographic Topographic Center DMAHTC in Washington DC). Following the analysis, the report documents a design trade off of various approaches to a Source Assessment System. Finally, a Design Plan for the selected approach analog-digital video system, is presented. Author (GRA)

N82-25623# Western Geophysical Co of America, Houston, Tex Aero Service Div
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY BARROW QUADRANGLE, ALASKA, VOLUME 2 Final Report
 Mar 1981 63 p refs 2 Vol
 (Contract DE-AC13-76GJ-01664)
 (DE82-000342, GJBX-295-81-Vol-2) Avail NTIS
 HC A04/MF A01

Volume II contains the flight path map, multiparameter profiles, histograms and anomaly maps for potassium, uranium, thorium uranium/potassium, uranium/thorium, and thorium/potassium GRA

N82-25635*# Detroit Diesel Allison, Indianapolis, Ind
LOW NOx HEAVY FUEL COMBUSTOR CONCEPT PROGRAM Final Report
 A S Novick and D L Troth Oct 1981 206 p refs
 (Contracts DEN3-148 DE-A101-77ET-13111)
 (NASA-CR-165367, NAS 1 26 165367, DDA-EDR-10594
 DOE/NASA/0148-1) Avail NTIS HC A10/MF A01 CSCL 10B

The development of the technology required to operate an industrial gas turbine combustion system on minimally processed, heavy petroleum or residual fuels having high levels of fuel-bound nitrogen (FBN) while producing acceptable levels of exhaust emissions is discussed. Three combustor concepts were designed and fabricated. Three fuels were supplied for the combustor test demonstrations: a typical middle distillate fuel, a heavy residual fuel, and a synthetic coal-derived fuel. The primary concept was an air staged, variable-geometry combustor designed to produce low emissions from fuels having high levels of FBN. This combustor used a long residence time, fuel-rich primary combustion zone followed by a quick-quench air mixer to rapidly dilute the fuel rich products for the fuel-lean final burnout of the fuel. This combustor called the rich quench lean (RQL) combustor, was extensively tested using each fuel over the entire power range of the model 570 K engine. Also a series of parametric tests was conducted to determine the combustor's sensitivity to rich-zone equivalence ratio, lean-zone equivalence ratio, rich-zone residence time and overall system pressure drop. Minimum nitrogen oxide emissions were measured at 50 to 55 ppmv at maximum continuous power for all three fuels. Smoke was less than a 10 SAE smoke number MG

N82-25661*# National Aeronautics and Space Administration Langley Research Center Hampton Va
IN SITU OZONE DATA FOR COMPARISON WITH LASER ABSORPTION REMOTE SENSOR 1980 PEPE/NEROS PROGRAM
 David S McDougal Robert B Lee, III and Richard J Bendura
 May 1982 42 p refs
 (NASA-TM-84471, NAS 1 15 84471) Avail NTIS
 HC A03/MF A01 CSCL 13B

Several sets of in situ ozone (O3) measurements were made by a NASA aircraft in support of the laser absorption spectrometer (LAS) remote sensor. These measurements were designed to provide comparative O3 data for the LAS sensor. The LAS, which was flown on a second aircraft remotely measured the vertical burden of O3 from the aircraft to the surface. In situ results of the air quality (O3 and B sub scat) and meteorological (temperature and dewpoint) parameters for three correlative missions are presented. The aircraft flight plans, in situ concentration profiles and vertical burdens, and measurement errors are summarized B W

N82-25811*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
AN ASSESSMENT OF THE REAL-TIME APPLICATION CAPABILITIES OF THE SIFT COMPUTER SYSTEM
 Ricky W Butler Apr 1982 17 p refs
 (NASA-TM-84482, NAS 1 15 84482) Avail NTIS
 HC A02/MF A01 CSCL 09B

The real-time capabilities of the SIFT computer system, a highly reliable multicomputer architecture developed to support the flight controls of a relaxed static stability aircraft are discussed. The SIFT computer system was designed to meet extremely high reliability requirements and to facilitate a formal proof of its correctness. Although SIFT represents a significant achievement in fault-tolerant system research it presents an unusual and restrictive interface to its users. The characteristics of the user

interface and its impact on application system design are assessed Author

N82-25827# Air Force Wright Aeronautical Labs, Wright-Patterson AFB, Ohio Structures Test Branch
STRUCTURES TESTING ANALYSIS REAL-TIME NETWORK (STARNET) Final Technical Report, Feb. 1976 - Feb. 1981
 Robert L Denison Oct 1981 93 p
 (AF Proj 1347, AF Proj 2401)
 (AD-A111636, AFWAL-TR-81-3112) Avail NTIS
 HC A05/MF A01 CSCL 14/2

The computer network employed for data acquisition and processing in the Structures Test Facility of the Air Force Wright Aeronautical Laboratories, Building 65, Area 8, Wright-Patterson AFB is extensively described. The report includes a system overview and discussions of subsystem characteristics and interconnections, system software, applications software, system operation, and a review of a large-scale network mode application. This computer network, called STARNET, is an on-line real-time system Author (GRA)

N82-26005# Hughes Research Labs, Malibu, Calif
SILICON LIQUID CRYSTAL LIGHT VALVE FOR FLIGHT SIMULATION APPLICATIONS Final Report
 U Efron J Grinberg, P G Reif, and P Braatz Brooks AFB, Tex AFHRL Nov 1981 118 p refs
 (Contract F33615-79-C-0024 AF Proj 2363)
 (AD-A110928, AFHRL-TR-81-35) Avail NTIS
 HC A06/MF A01 CSCL 20/2

The basic objective of this program has been to develop a silicon photoconductor liquid crystal light valve (Si LCLV) for application in wide-field-of-view simulators. The Si LCLV is expected to offer several advantages over the cadmium sulfide (CdS) photoconductor LCLV, including higher sensitivity, a significantly better switching ratio, higher resolution, and (most importantly) a fast response time to allow higher 60-Hz operation. The main thrust of this program was to upgrade the device in the following areas: (1) Scale up to a 2-inch aperture device (from a 1 cm x 1 cm active area) (2) Implement the silicon/silicon dioxide (Si/SiO2) dielectric mirror and improve the light blocking layer (3) Upgrade device resolution by optimizing the focusing grid (4) Increase the contrast ratio by improving silicon processing (5) Implement the dc-biased guard ring to prevent edge breakdown (6) Optimize liquid crystal operation to reduce the response time. Significant improvements were achieved in all areas GRA

N82-26162# Indian Inst of Tech, Bombay Dept of Aeronautical Engineering
INVESTIGATION ON ROTATING AILERONS
 S Mozumdar and T S Patel /In Indian Inst of Science The J of the Aeron Soc of India, Vol 32, No 1-4, Feb-Nov 1980
 Nov 1980 p 1-5 refs

Avail NTIS HC A08/MF A01

The effectiveness of rotating ailerons in a subsonic flow was theoretically studied with a view to evaluate their capability in comparison to the conventional ones. The present analysis is based on the vortex lattice approach of Byelotserkovskii for different wing planforms of small and large aspect ratios. The effect of such ailerons on the coefficients of lift and rolling moment was worked out for their positions corresponding to the most suitable positions of rotating flaps Author

N82-26184# CIERS Research and Consultancy Private Ltd, Bangalore (India)
PRIMARY SEWAGE TREATMENT PLANT AS A SOURCE OF BIRD HAZARDS AT AIRPORT
 S C Pillai, M K C Sridhar, and G Kasi Viswanath /In Indian Inst of Science The J of the Aeron Soc of India, Vol 32, No 1-4 Feb-Nov 1980 Nov 1980 p 149-153 refs

Avail NTIS HC A08/MF A01

Quantitative observations were made on the visits of different kinds of birds, notably eagles or kites and crows, and on their movements around the different parts of the primary sewage treatment plant located in the neighborhood of the airport at Bangalore. The following information is reported: (1) early records on collisions between birds and aircrafts, (2) bird strike as a world wide problem, (3) the reasons for the attraction of birds to airports, (4) early attempts to solve the problem of bird hazards.

N82-26185

and (5) the conditions in India. Suggestions are made to prevent bird visits to the airport area. E A K

N82-26185# Office National d'Etudes et de Recherches Aérospatiales, Paris (France)

LA RECHERCHE AEROSPATIALE, BI-MONTHLY BULLETIN, NUMBER 1981-6, NOVEMBER-DECEMBER 1981

Claude Sevestre, ed. Paris: ESA, Mar 1982. 72 p. refs. Transl. by ONERA into ENGLISH from La Rech. Aérospatiale, Bull. Bimestriel (Paris) No. 1981-6, Nov.-Dec. 1981. Sponsored by ESA.

(ESA-TT-741) Avail. NTIS HC A04/MF A01, original report in FRENCH available at ONERA, Paris FF 55.

The interaction of an oblique jet with a subsonic flow was studied. Aerodynamic flow measurement, using fluorescence and laser Doppler velocimetry are discussed. Fatigue crack propagation, and subsonic flutter of compressor blades were examined. Approximate compressibility relations and Euler equations of motion are treated. An implicit pseudo unsteady calculation method for transonic flow is presented.

N82-26189# Office National d'Etudes et de Recherches Aérospatiales, Paris (France)

AEROELASTICITY OF COMPRESSOR BLADES SUBSONIC STALL FLUTTER

H. Loiseau and E. Szechenyi. In: *La Rech. Aérospatiale*, Bi-monthly Bull. No. 1981-6, Nov.-Dec. 1981 (ESA-TT-741) Mar 1982, p. 47-59. refs. Transl. by ONERA into ENGLISH from La Rech. Aérospatiale, Bull. Bimestriel (Paris) No. 1981-6, Nov.-Dec. 1981.

Avail. NTIS HC A04/MF A01, original report in FRENCH available at ONERA, Paris FF 55.

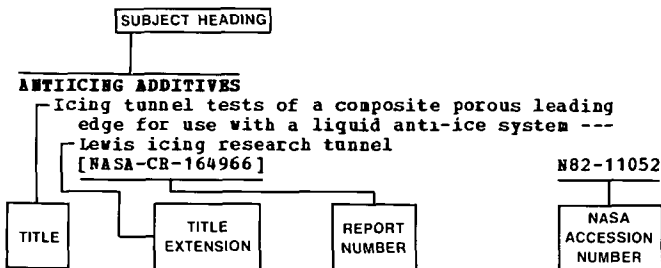
The aeroelasticity of turbomachine blades, of cascade wind tunnel and performance tests, were analyzed. Wind tunnel tests involved excitation by hydraulic actuators and pressure transducer measurements. It is found that unsteady pressures causing stall flutter are located on the upper surface, principally in the operating domains where flow is completely separated, while instability is principally a function of the angle of attack. The phase lag of unsteady pressures increases with vibration frequency. When it is sufficiently large, the flutter disappears, even under suitable separation conditions. Unsteady lift and moment, induced by a vibratory pitching movement around any axis, are obtained by linear superposition of forces due to heaving and a pitching movement around a given reference axis. The wind tunnel simulated closely compressor flows with good periodicities in five interblade channels. Author (ESA)

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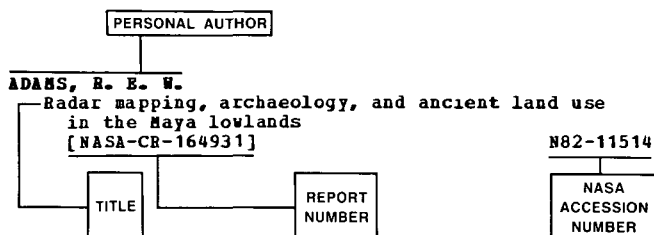
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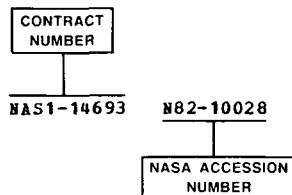
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